Plant Engineering

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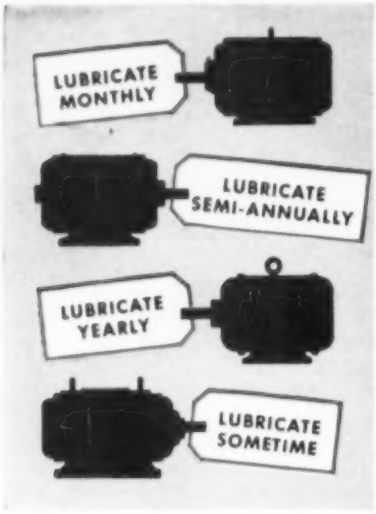
The magazine that helps plant engineers with their everyday problems

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Why take a chance with "Once-in-a-while" lubrication?

Why fuss with motors that require lubrication "every so often?" Whether it's monthly, yearly, every two or three years, or just an indefinite "sometime," it is as much trouble remembering when to lubricate, as it is to do the lubricating. And it certainly isn't a very good way of making sure bearings get proper greasing attention.

There *is* one way to be *sure*. That's with Life-Line motors. Lubrication is *positive*. Bearings are pre-lubricated and factory-sealed. *No* further lubrication is required!

This is the modern way of lubricating motors. Development of special lubricants, up-to-date manufacturing methods and special seals have made it possible.

Records of nearly half a million motors, operating in every type of industry, indicate that pre-lubricated bearings offer: an average saving of $2.70 yearly per motor . . . 41% fewer motor outages due to faulty lubrication . . . complete freedom from lubrication attention.

Today, periodic lubrication is a costly nuisance. So why take a chance with it when Life-Line offers positive lubrication at no extra cost. See for yourself. Ask your Westinghouse representative for a copy of "Facts on Pre-Lubricated Bearings," B-4378, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

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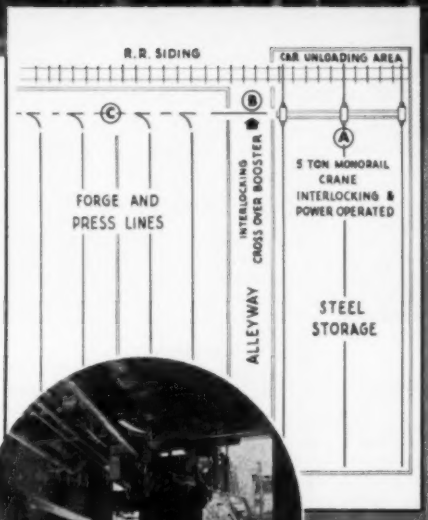

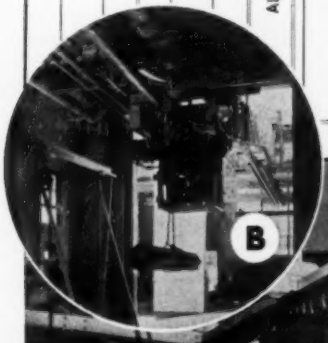

Interlocking

MONORAIL SYSTEM

Solves Steel Distribution Problem

At the Columbus plant of The Jeffrey Manufacturing Company, steel is unloaded from cars or trucks and placed in storage with a 5-ton high speed MonoRail crane. Stock is transferred from storage to press and forge shops by the same crane with carrier transfer across interlocking booster between storage and shops. Steel is distributed in shops by means of finger-tip control power operated MonoRail carrier.

The solution of this problem is made possible by extended hook coverage across interlocking tracks between buildings.

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'ROUND ABOUT with the editors in field and office

News About Many Plant Engineers

JACOB DYKSTRA, plant engineer of the Golden State Milk Products Co., Guadalupe, Calif., recently retired to his ranch. His present address is Box 1001 Guadalupe, Calif.

J. R. CALLAHAN, formerly plant engineer of E. R. Squibbs & Sons of Brooklyn, New York, has recently retired. A. G. QUADRINE is now superintendent of maintenance utilities department and R. NIEMANN is construction section head of this company.

GEORGE GABRIEL, formerly plant engineer of The Atlas Mineral Products Co., at the Mertztown, Pennsylvania, Plant, was recently promoted to Assistant Plant Manager. Mr. Gabriel received his degree in Chemical Engineering from Pennsylvania State College.

INTERNATIONAL Harvester's McCormick Works in Chicago recently appointed former Assistant Plant Engineer DAN MCNALLY to the position of plant engineer. Mr. McNally replaces JACK STEWART who has moved to Arizona because of poor health.

Maintenance — Plant and Paint

SMALL PLANT MAINTENANCE is, in my considered opinion, a clear-cut presentation of facts pertaining to plant maintenance which could only be learned through actual experience. The article should be read and studied by all top brass. The article on Paint Maintenance is timely. Most appropriate for us who do not know enough about the correct painting procedure and the real reasons for most paint failures. *W. J. Neely, Plant Engineer, The W. T. Rawleigh Company, Freeport, Illinois.*

The Customer Is Always Right

QUESTIONNAIRES are prevalent at the moment. The reason is obvious for this is the most effective method of getting an answer quickly from a large number of people. Recently, 1,163 buyers used this method to tell Monsanto Chemical why the name polystyrene should be changed to styrene. This is a technical designation of a series of plastics widely used in industry.

Charles Litchenberg, Assistant General Sales Manager of the Plastics Division, said that the results of the poll are "strong evidence of the growing trend toward simplification of generic and trade names."

Customers were less erudite but preferred the simplification because it was easier to pronounce; easier to remember; easier to use; easier to spell; more appealing; and more adaptable to uniform usage. Apparently, human nature runs true to form, for these are exactly the reasons readers give for liking PLANT ENGINEERING.

How One Engineer Fools the Bugs

WAS GLAD to see your article on DDT (page 52, June 1950) and believe that a subsequent article on chlordane would be in order. I have found this very effective in bug control, using a 2 per cent solution in what is apparently a Kerosene base spray.

As stated in the article, there is some evidence that certain insects may build up, in subsequent generations, a resistance against insecticides. I rotate each year to fool the bugs, first using DDT, then chlordane and then methoxchor.

Recently the New York Times published a list of chemicals most widely used as insecticides, listed in the order, approximately at least, of their increasing toxicity. This list is as follows: 1. Methoxchlor; 2. DDD (Rothane); 3. Pyrethrine; 4. Rotenone; 5. Chlordane; 6. DDT (Dichloro-diphenyl-trichlorethane); 7. BHC (gamma-benzene-hexchloride); 8. Toxaphene; 9. Nicotine; 10. TEPP (tetra-ethyl-pyrophosphate); and 11. Parathion.

Apparently there is some difference of opinion as to relative toxic effects to different insects and to humans. *R. Squires, PE, National Publishing Co., Philadelphia, Pa.*

Would You Like to Be an Editor? We Need Another on Our Staff!

THERE IS an opening on the Plant Engineering editorial staff for a young man of around 30 yr of age who has a good personality and common sense and who likes to meet people, travel and write. He does not have to be a gifted author but must be able to write clear and concise English. He should have: an engineering education; at least 4 to 6 yr practical experience as a plant engineer; and, if a veteran, preferably service as post engineer or in air corps maintenance. If you qualify and are interested in a congenial occupation write The Editor, PLANT ENGINEERING, 110 South Dearborn Street, Chicago, Illinois.

THE Armstrong hardened chrome steel valve opens wide and closes tight — with a snap! This eliminates throttling and consequent wire drawing. The Armstrong free-floating lever mechanism is almost frictionless. The bucket and valve lever assembly are 18-8 corrosion resistant stainless steel. The mechanisms of Armstrong steam traps for low and medium pressures are identical in materials and workmanship to those used in Armstrong traps for pressures to 1500 psi, 900 F.

There is nothing in an Armstrong trap to bind, stick, collapse or leak. *Now is the time to quit working for your steam traps and buy the traps that will work for you.* Call your nearby Armstrong representative today.

ARMSTRONG MACHINE WORKS

912 Maple St., Three Rivers, Mich.

50% SAVINGS IN MAINTENANCE since installing Armstrong steam traps on the heating system at *John Deere Ottumwa Works, Ottumwa, Iowa.* This is typical of reports from Armstrong users.

THE 36-PAGE ARMSTRONG STEAM TRAP BOOK contains complete data on the design, operation, selection and installation of Armstrong steam traps for all services. Send for your free copy.

ARMSTRONG STEAM TRAPS

Constructed to Take Severe Punishment

Without Tube Swelling

CONCORD #20 STEAM HOSE

Here's the steam hose with a structural difference that eliminates . . . once and for all . . . the common failure of tube swelling under continuous high pressure operation.

CONCORD #20 Steam Hose gives you the exclusive protection of a tough inner lining . . . a lining of stainless steel wire braid. This braid assures permanent retention of the original inside hose diameter. It prevents swelling and constriction of the tube . . . assures full flow of steam at all times . . . permits re-coupling in the field when necessary, without the slightest difficulty.

In addition, CONCORD #20 construction features include: two or three braids (depending on size) of alternate high tensile steel wire and rubber layers are firmly bonded over the outside of the tube. They provide maximum burst-protection and safety. An asbestos braid provides positive cover adhesion and serves as cover insulator. On top of all is the rugged, abrasion-resistant cover that withstands the severest abuse.

Flexible, tough and dependable . . . that's BWH's new CONCORD #20! Ask your nearby BWH distributor for a demonstration. Get in touch with him today, or write us direct.

Tube Securely Locked by Special Stainless Steel Inner Wire Braid!

Illustration above shows how exclusive inner stainless steel braid of CONCORD #20 Steam Hose prevents tube swelling and assures long life under severe use.

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

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BWH
DEPENDABLE RUGGEDNESS

How to save money for your company on ROOFING and SHEET METAL WORK

Plant engineers, superintendents, maintenance men—and all those interested in dependable, low-cost industrial roofing—will find this chart valuable. With it, you can quickly determine suggested gauges of Monel® Roofing Sheet for principal sheet metal building applications.

Keep this chart for ready reference

APPLICATION	U.S.S. GAUGE	THICKNESS IN INCHES
Flat Seam Roofing	25	.021"
Standing Seam Roofing		
Pans (20" Wide)[1]	26	.018"
(24" Wide)[1]	25	.021"
Valleys	26	.018"
Eaves	24	.025"
Batten Seam Roofing		
Pans (20" Wide)[1]	26	.018"
(24" Wide)[1]	25	.021"
Cover Strips	26	.018"
Valleys	26	.018"
Eaves	24	.025"
Cleats	26	.018"

[1] *Indicates width of Sheets not width of Pans.*

Thru Wall Flashings[2]		
Flashings	26	.018"
Counter, Base and Cap Flashings		
Counter Flashings	26	.018"
Cap Flashings	26	.018"
Base, over 10" width	25	.021"
Base, 10" and under	26	.018"
Gutters[3]		
Gutter Linings		
36" Girth and smaller	25	.021" min.
36" to 48" Girth	24	.025" min.
48" Girth and larger	22	.031" min.
Molded Gutters	25	.021"
Hung Gutters	26	.018"
Gutter Expansion Joints	26	.018"

[2] *A patented, interlocking thru-wall flashing is available from Keystone Flashing Co., Philadelphia, Pa.*

[3] *Thicknesses suggested are minimum and heavier gauges may be indicated depending upon design and proposed method of installation.*

(NOTE: For replacement work where expansion joints and downspouts are more than 40 feet apart, 22 ga. (.031") Monel should be considered.)

Leaders		
Downspouts	26	.018"
Heads	26	.018"
Straps	26	.018"

APPLICATION	U.S.S. GAUGE	THICKNESS IN INCHES
Valley Flashings		
With Wood or Asphalt Shingles	26	.018"
With Slate or Tile Roofing	24	.025"
Expansion Joints		
Exterior Walls	26	.018"
Roof Curbs	25	.021"
'V' Cover and Floors	26	.018"
Eaves Flashings	26	.018"
Louvers (Stationary)[4]		
Frame Covering	26	.018" min.
Louver Slats (under 6 ft.)	25	.021" min.
(over 6 ft.)	24	.025" min.
Vertical Strips	24	.025" min.
Gravel Stops		
Stops	25	.021"
Edge Strips	24	.025"
Coping Cover		
Edge Strips on Wood Copings	24	.025"
Edge Strips on Stone Copings	22	.031"
Standing Seam	26	.018"
Flat Sheet Coping	25	.021"
Cornices and Belt Courses		
Edge Strip on Wood Cornices	24	.025"
Edge Strip on Stone Cornices	22	.031"
Belt Courses	22	.031"
Flat Covering	25	.021"

[4] *Gauges recommended are minimum and heavier gauges might be indicated depending upon design, number of structural supports and method of joining called for.*

Skylights		
Caps	25	.021"
Condensation Gutter	26	.018"
Sidings (Bulkheads—Elevator, Penthouse and Staircase Shafts)		
Flat Sheets	25	.021"
Crimped, Keyed and/or Corrugated	26	.018"

These gauges, you'll note, are somewhat lighter than you might ordinarily specify. But service records prove that relatively light gauge Monel can safely be used—even under such severe conditions as are often found in many coastal cities and industrial areas.

Among the important reasons for this are the high corrosion-resistance and mechanical properties of Monel. This dependable Nickel Alloy withstands attack by smoke, rain and chemical fumes. It endures heat and cold with less buckling and no cracking. It has the strength to stand snow, ice and tearing winds. It takes years of flexing without showing signs of fatigue.

Keep Monel in mind—not only for entire roofs—but also for drainage systems, flashings, ventilators, louvers, skylight frames, siding, expansion joints, coping, gutters and downspouts. Its initial cost is low, its maintenance expense negligible.

When you need help

On request, The International Nickel Company will send you detailed information on the use of Monel Roofing Sheet. There is no charge or obligation for this service. If you want samples of Monel Roofing Sheet, or illustrated descriptive literature, you need only ask for them.

The particularly useful bulletin, *Monel Roofing Sheet — Basic Application Data*, from which the above chart was adapted, contains a full review of the properties and characteristics of Monel, a discussion of installation procedures, and a sample specification wording. A copy deserves a place in your file. May we send it to you?

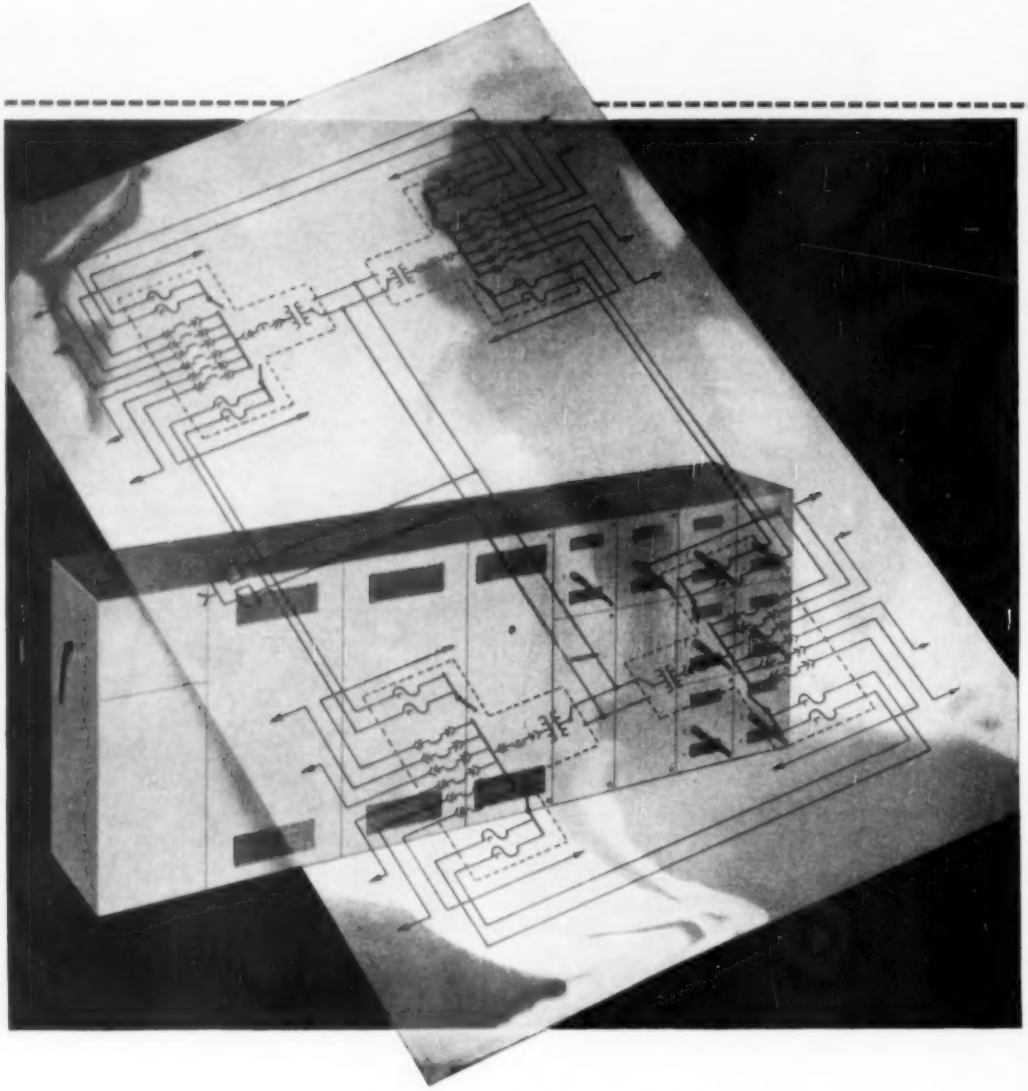
MONEL... *for the life of the building*

EMBLEM OF SERVICE INCO TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



PRIMARY SELECTIVE NETWORK SYSTEM

This modern distribution system provides maximum flexibility to meet changing load conditions. It provides very reliable service with very good regulation and efficiency. By sacrificing these characteristics to some degree it is possible to use other systems whose initial investment is less. To evaluate the system most desirable for your plant, consult your Westinghouse Representative.

Visualize

your power problem this way

Any old way of running wires to your equipment may work . . . but what about efficient, profitable operation?

A modern electrical distribution system can make electrical power do more of *your kind* of work. But again, just any of the modern systems won't do, because there is no all-purpose system to balance all factors. *That's why it's imperative that your system be planned to meet your specific needs.*

Power centers provide the simplest way—the low-cost way—of attaining the system you require.

Westinghouse Indoor Dry-Type Power Centers give you these advantages:

THEY'RE MORE ECONOMICAL—because they eliminate the need for costly vaults and can be located near center of load . . . resulting in shorter secondaries, lower line losses, better regulation.

THEY COST LESS TO MAINTAIN—no liquids to test, recondition or replace . . . no gaskets, valves or gauges. All parts are readily accessible.

THEY'RE SAFER—fire and explosion-proof, they have no exposed live parts. Each breaker is enclosed in an individual compartment. Positive interlocking prevents false breaker operation.

Your Westinghouse Representative will be glad to discuss your system problems with you. He is prepared to offer complete system information, with advantages of each carefully weighed.

Ask him for Booklet B-4045, "Industrial Power Distribution Systems" and B-4162, "Power Centers by Westinghouse". Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60732

Westinghouse

POWER CENTERS

PLANT ENGINEERS' DIGEST so those who rush may read and know what's new

Solving Pollution Problems

INDUSTRIAL POLLUTION of streams and bays resulting from the use of certain toxic chemicals is one of the problems always confronting industry. Like all tools, these chemicals must eventually be disposed of as waste. If not properly handled at that time, they can pollute sewers, streams or the underlying earth.

After consultation with the three regulatory government agencies with jurisdiction over pollution in Seattle, the Boeing Airplane Company's plant engineering department made a careful study and proposed a specific pollution-control program for its Seattle operations.

Certain oily wastes such as turnings from lathes are carried to a specially-built area in the salvage yard and left there to drain before disposing of them as re-usable metal. The walled and diked area in the salvage yard channels the oil drippings to a sump; from there the oil is drawn into tanks and burned in an incinerator. Unreclaimable waste paper and other inflammable scraps are burned in this incinerator, too; its chimney is equipped with a water spray to prevent fly ash from getting out.

Chemical waste being poured into three sumps marked acid, water and alkali; from these it leaches into the earth, becoming harmless on way to river

Some waste alkali and acid solutions, only mildly caustic or toxic, are poured into the appropriate one of three 1000 gal cistern-like sumps. Situated at a suitable distance from the river, these sumps are lined with porous brick, laid without mortar in their vertical interstices. The liquids leach gradually into the ground, and, by the time they have made their slow progress to the river bed, their toxicity has disappeared.

Waste toxic solutions, when of extreme concentration, are sealed inside steel drums, put aboard a ship and dumped at sea beyond the continental shelf.

The biggest problem confronting the company was the treatment of cyanide waste. The problem was to transform the cyanide, thus removing the toxicity, and then to dilute the remaining solution, for run-off into the river.

As a final check on the cyanide-disposal method, to make certain this could be done, the Plant Engineering Department arranged to have a pilot plant set up. In it, the highly-toxic cyanide waste was oxidized by treatment with sodium hypochlorite or calcium hypochlorite — thus turning it into cyanate, which is only one one-thousandth as toxic as cyanide.

After the most satisfactory method of oxidizing the cyanide sodium hypochlorite had been ascertained with the pilot plant, plans were made for construction of a 6000 gal full-scale, factory-wide, liquid-waste, pollution-control system. A pipe network will carry the treated solutions to the outflow. There they are mixed with the copious flow of dilution water; the entire mixture is then sluiced into the river. For an operational safeguard, a dribble is constantly taken from the outflow for sample purposes. Once every eight hours of plant operation this is scrutinized for cyanide determination. *From an article by Louis R. Huber, in Boeing Magazine, a publication of Boeing Airplane Co., Seattle, Wash.*

Blow Your Own Snow

HOW WOULD you like to make a snow blower to take care of your winter chores of cleaning sidewalks and driveways? The problem is not too difficult and can be accomplished with a little ingenuity and hard work.

The one pictured was constructed by taking a plate of steel 16 in. in diameter and welding 4 blades to it, then it was balanced for high speed. A housing was then built around it, leaving a chute extending off to the right. Ball bearings were used to make it run easy because of the type of engine installed to drive it. The housing, handles and runners were welded together.

Home-made snow blower does a neat job of keeping sidewalks and driveways clear of snow during the winter months

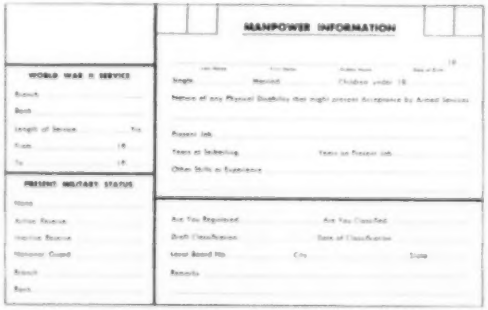
The finished job comes in handy when Old Man Winter drops around in force. The snow is blown 15 to 20 ft. *From an article by W. J. French, in The Stabilizer, a publication of the Lincoln Electric Co., Cleveland 1, Ohio.*

Finger-tip Tank Gauging

INSTEAD OF gaugers walking to each big oil storage tank on a large pump station tank farm to learn the volume of oil from gauges at eye level, they can now sit in their office and press a button to get the same information.

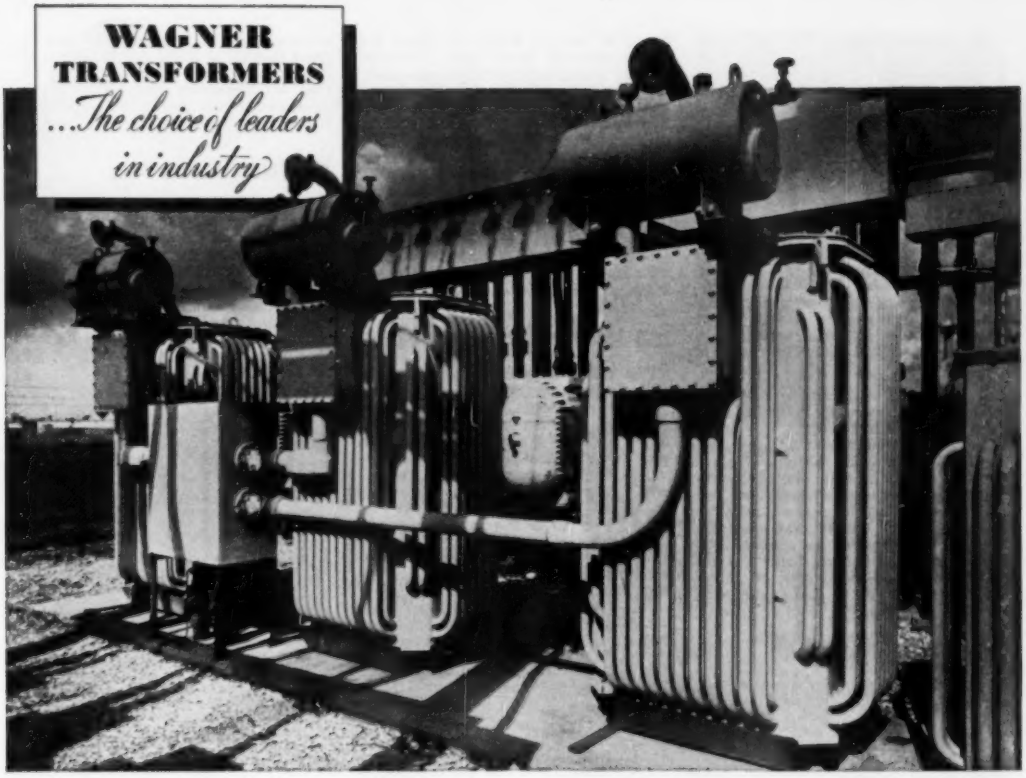
The electric remote tank reading system has made all this possible. Each

What Is Your Military Status?



This sample form is being filled out by all Seiberling employees so that the company will have an up-to-the-minute record of the manpower employed. (From The Seibeneer, a publication of Seiberling Rubber Co., Barberton, Ohio.)

WAGNER TRANSFORMERS
...The choice of leaders in industry



Bank of 667 kva, 1 phase, 60 cycle, 2400 to 480 volt Transformers

Wagner Transformers power the production of Rohm & Haas "Chemicals for Industry"

Production of "Chemicals for Industry" by the Rohm and Haas Company, makers of famed Plexiglas, is not a simple one-plant operation. The products of one of their plants may have no resemblance to the commercial products into which they are integrated at another plant. The natural raw material found in Texas, for instance—the processed chemicals manufactured there—and Plexiglas, an end product manufactured in another plant—are all part of a great modern production chain.

Power for production—with Rohm and Haas as with any modern industry—is provided by electricity. The manufacture of chemicals in the Rohm and Haas plant in Deer Park, Texas, is powered by Wagner Transformers and Wagner Motors. Wagner transformers in the main substation take energy at 69,000 volts and feed it to the low voltage substation at 2400 volts. The low voltage substation of Wagner transformers (illustrated above) in turn furnishes 480 volts to motors and to small air-cooled Wagner transformers which furnish 120 volts for lights and other single phase loads.

Thirty-one branch offices, located in principal cities, are ready to help you whenever you have a transformer problem. Users of Wagner Transformers also benefit by nationwide service facilities. Write for Bulletin TU-180 and TU-181 for full information on Wagner Power and Distribution Transformers.

WAGNER ELECTRIC CORPORATION
6492 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation EST. 1891

ELECTRIC MOTORS - TRANSFORMERS - INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS - AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

Gauger selects a tank and presses button on panel in office to get exact measurement of oil level in large storage tanks at the pipe line station

tank in a large tank farm is connected to the central board in the office. The gauger simply turns a dial to the number of the tank he wishes to gauge and presses a button. On the panel before him the hands on two dials begin to move. In a matter of seconds they tell him in feet and inches, accurate to within 1/16th of an inch, how much oil is in the tank. By using a simple table, he can interpret this in terms of barrels. *From The Humble Way, a publication of Humble Oil & Refining Co., Houston 1, Texas.*

Have a Cup of Safety

Slogans on the two sides of paper cups serve as safety reminders every time employees use them. (From Carboloy Bits, a publication of Carboloy Co.)

Shoring Fits to a "T"

IN THE CONSTRUCTION of a new building the usual sight is a forest of lumber, represented in rows upon rows of 4 by 4 in. wooden shores used while the job of pouring reinforced concrete is being done.

The steel T-shores are easily carried and can be erected without tools. Only half the number of steel shores are required over the wooden shore method

This is not so in the case of the new three story bakery building under construction by the Central Manufacturing District for the Great Atlantic and Pacific Tea Co. You won't find the forest of lumber, but in its place are neatly erected steel pipe T-shores, trussed steel joists and steel pipe bracing. It is expected to represent approximately 25 per cent savings in material and labor in the forming and shoring construction of the building.

The steel shores used to replace the wooden shores are easily adjustable. No tools are used in putting them up, no nails are required, and only half the number of shores are needed over the wooden shore method to do the same job. *From Central Manufacturing District Magazine, a publication of Central Manufacturing District, Chicago, Ill.*

How to Recognize Flash Steam

The steel shores used to replace the away in the open air is likely to cause any cost-conscious engineer to do slow rolls. An interesting switch, however, is the fact that this white steam might well be a sign that the trap is performing its function perfectly—it is taking condensate at steam temperature out of a unit that contains steam under pressure. Such is the case with flash steam.

Under pressure, steam can become condensate even though the temperature exceeds that of normal boiling point of water, 212 F. When this water is released to the open air or to a lower pressure, it reverts to a vapor state—"flashes" into steam because of the sudden liberation of excess heat which the water contains.

It is only natural, therefore, that flash steam occurs in the discharge from a steam trap. If the trap discharges to the open air, the formation of flash steam will be visible; but if it discharges into a return line, the flash steam will be out of sight and will be quickly condensed by radiation losses from the return line.

In about 99 cases out of 100, flash steam will never do any harm. Nevertheless, many trap users become confused by the appearance of clouds of flash steam and naturally fear that it is a leakage of live steam.

Here is a simple rule for distinguishing flash steam from real steam leaks that can be prevented. First, disconnect or open up the outlet line on the trap. If a continuous blow of "blue" steam occurs, it is a real leak and the trap valve should be inspected; but, if steam is only visible intermittently at the time the trap discharges, then it is only flash steam.

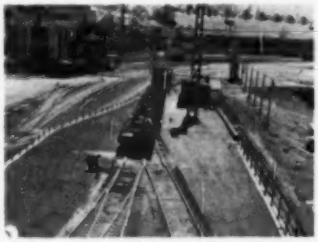
In the small percentage of cases where flash steam may cause trouble, the trouble is not due to loss of heat but to the bulkiness of the steam. Thus, when a trap discharges into an undersize return line, the formation of flash steam may cause back pressure to build up and then the capacity of the trap is materially reduced. The solution for this trouble is to install a larger return line.

One more possibility of trouble with flash steam is when a long or undersize inlet line is used on a trap. In such cases, the drop in pressure that takes place when the trap discharges extends even into the inlet line and flash steam may form. This steam will float the trap bucket, thereby closing the discharge valve, even though the inlet line is full of water. The solution for this is to install a larger inlet line so that the pressure drop in the line will not be great enough to allow the formation of flash steam. *From an article by T. H. Ree, in Armstrong Trap Magazine, a publication of Armstrong Machine Works, Three Rivers, Mich.*

Mill Yards Sparkle Now

AS PART OF the long-range safety and housekeeping project launched several months ago, Weirton Steel Company's mill yards are being paved with blacktop or concrete.

The housekeeping end of the job is being tackled by a diesel-powered cleaner with a rotary broom for sweeping and a magnet for picking up scrap. This cleaner is doing an excellent job of keeping the surrounding railroad beds clean.



This spotless mill yard is the result of paved yards and constant housekeeping with cleaner equipped with rotary broom and a magnetic attachment

The paving operation plus the housekeeping task has resulted in clean, spotless mill yards of which the company is rightfully proud. *From Employees Bulletin, a publication of Weirton Steel Co., Weirton, W. Va.*

Less Lubrication With Nylon Plastic

NYLON PLASTIC reacts to lubrication like the proverbial camel to water; a little goes a long way. This is perhaps most evident in textile machinery. In spinning frames, there is a part called a bolster which usually required lubri-

This nylon plastic bolster is made for use in textile machinery. It saves money because it requires only a few oilings

cation after 40 to 120 hours of operation. Those made of nylon plastic run for 1,560 hours without oiling.

(Continued on page 16)

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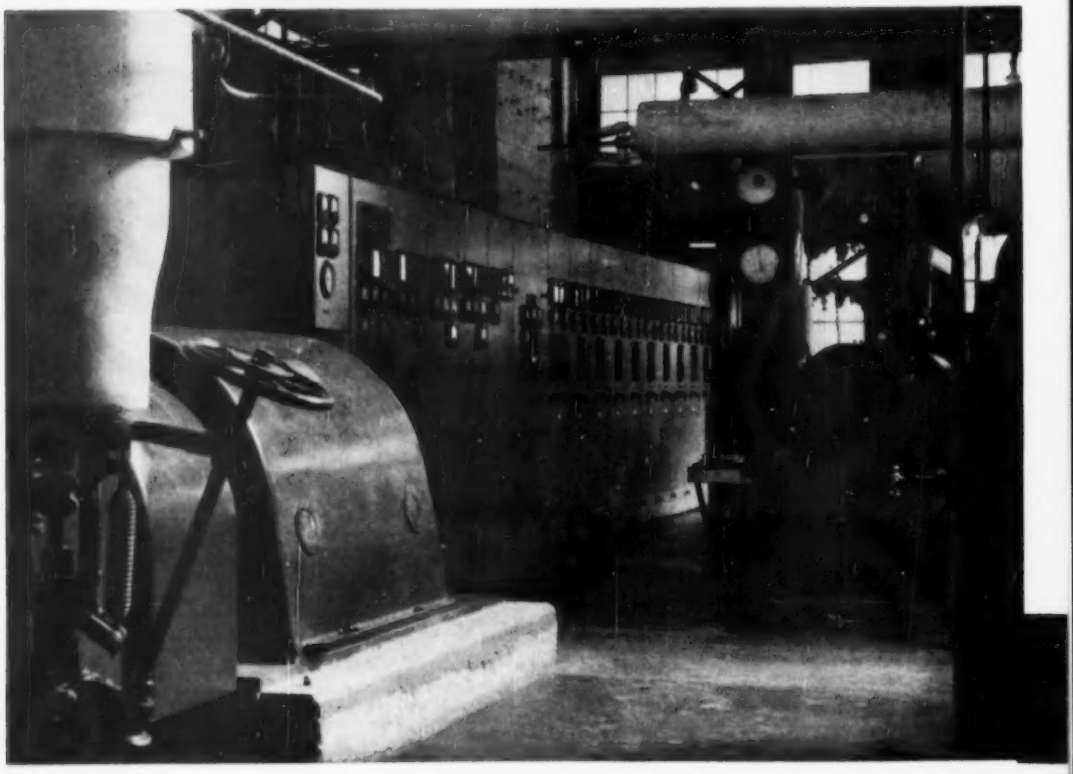
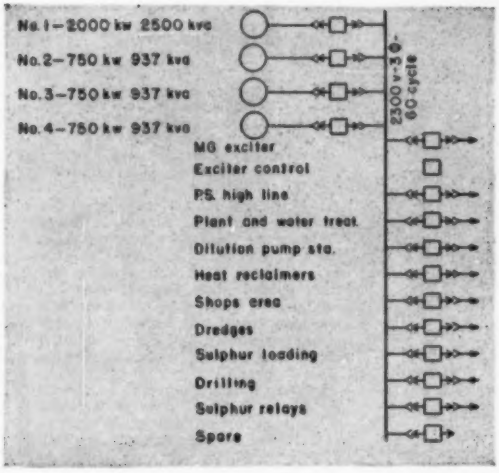
FREEPORT SULPHUR EXPANDS

This inadequate, open-type switchgear was replaced by the new G-E Metal-clad equipment shown below. Freeport Sulphur officials recognized that the old switchgear had outgrown its usefulness.

Here's the new General Electric 5-kv Metal-clad switchgear installed at Freeport Sulphur. Magne-blast power circuit breakers have plenty of "IC" (Interrupting Capacity) to handle all short circuits that may occur on Freeport's expanded distribution system. This assures continuous power for vital production.



AND MODERNIZES WITH METAL CLAD SWITCHGEAR



This one-line diagram shows power distribution at Freeport Sulphur as planned by Sargent and Lundy, consulting engineers of Chicago. General Electric Metal-clad switchgear handles the 2300-volt power from the generators through power circuit breakers of 100,000-kva interrupting rating.

The Freeport installation is a complete General Electric project—one source of responsibility plus the very best in co-ordinated planning, engineering, manufacturing, and service facilities to give maximum savings and efficiency to the customer.

Be sure to see the "More Power to America" full-color sound slide-film "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

WHEN Freeport Sulphur expanded their production facilities they put in a new turbine to take care of the increased load.

At the same time they replaced all their old equipment with General Electric switchgear.

When you order G-E switchgear you get all the equipment and service from one reliable source. And with everything pre-assembled at the factory it takes very little time to get the switchgear in place and operating.

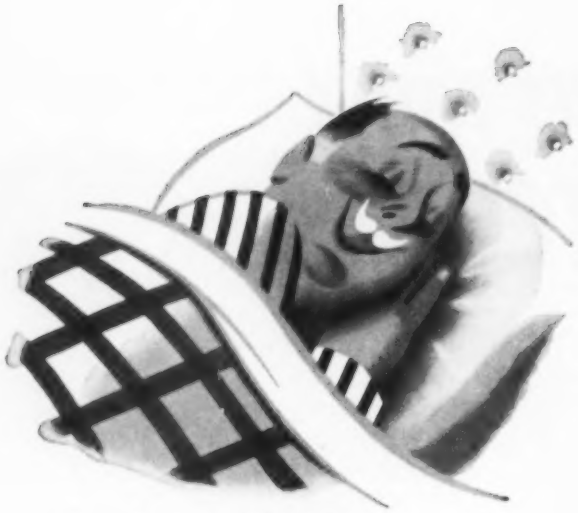
MODERN INDUSTRIAL power distribution systems using G-E switchgear are applicable to any industrial plant or commercial building where you want. . . .

- Proper voltage for top performance of equipment
- An extremely flexible setup to take care of expanding or changing loads
- Adequate short-circuit protection
- Protection for personnel
- Low installation and maintenance costs

INVESTIGATE TODAY the many advantages of using General Electric switchgear to get the same benefits gained by Freeport Sulphur. Contact your G-E sales representative for further information—or write for the helpful bulletins listed below. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GEA-3083 Metal-clad Switchgear
GEA-4966 Low-voltage Metal-enclosed Switchgear
GEA-3592 Load-center Unit Substations
GEA-3758 Load-center Power Distribution

GENERAL ELECTRIC



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(Continued from page 12)

A nylon plastic part is being used in helicopter transmissions, increasing their life from 25 hours to well over 1,000 hours. No standard anti-friction bearing small enough for the job would give more than 25 hours of reliable service life. Molded nylon cages were tried and found to be the answer.

Another use for this plastic is as a speedometer gear which operates off the transmission to drive the speedometer cable. It is also being used as the connecting rod in electric razors to transmit power from the motor to the shaver's cutting blade. *From Du Pont Magazine, a publication of E. I. Du Pont De Nemours & Co., Wilmington, Del.*

Rubber Cuts Highway Costs

A FIVE AND one-half mile, four-lane "rubber" highway, the longest of its kind in the world, was recently opened to Massachusetts motorists. Heretofore, the use of rubber in roads has been limited to test sections ranging from 100 ft to one and one-half miles in length.

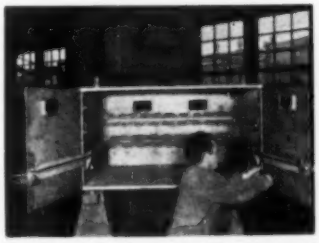
This new rubber highway is on the old Boston Post Road, now U. S. Route 1, the main highway running from Maine to Florida. It extends from the town of North Attleboro south to the Rhode Island state line. It was laid over an old and badly patched concrete base and is constructed of a combination of asphalt and a new meltable rubber compound developed by United States Rubber Co.

Highway officials expect it to give at least twice as much wear as standard asphalt resurfacing material. It will cut maintenance costs which were running as high as $1,000 per year per mile along that section of highway. *From US, a publication of United States Rubber Co., New York 20, N. Y.*

Improved Battery Maintenance

BATTERIES ASSEMBLED in roll-out cradles are being used by the Illinois Central Railroad as a means of improving battery maintenance.

It became evident that batteries so assembled were much easier to



One of battery boxes used to accommodate 25-cell batteries in final stage of fabrication. Note the door track rails

maintain than when assembled in conventional boxes and carlighting-type trays with skids. Maintenance forces reported that an entire 25-cell

(Continued on page 22)

stop coupling failures!

FIND OUT HOW *Koppers Engineers Eliminate Needless Downtime* IN YOUR PLANT!

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For *30 years,* Fast's Couplings have been industry's standard for *long life* at *low cost.* Now, in addition, when you specify Fast's you get the *extra* advantage of Koppers valuable Engineering Service. Koppers engineers, backed with 30 years of Fast's Coupling experience, study your problem. Then show *which* Fast's Coupling you need (and more important) *why you need it!*

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There is no wear on the shaft when a Garlock seal is used. Sealing is effected by leakless and positive contact between carefully lapped metal-to-carbon or metal-to-metal mating surfaces. One of these elements rotates with the shaft and the other is stationary. The stationary element does not contact the shaft.

These precision-built seals are made in several standard designs and in a wide range of highest grade materials. The selection of design and materials depends upon the service in which the seal is to be used. If none of our standard designs appears entirely suitable for any specific application, a modification of a standard design or a specially designed seal will be engineered and built for that job.

Thousands of GARLOCK MECHANICAL SEALS have proved their effectiveness, durability and economy on shafts operating at high and low speeds and pressures. Users of Garlock seals are enjoying many months—or years—of trouble-free operation on equipment handling various liquids such as, for example, water, gasoline, beer, acids and paint.

If you need Mechanical Seals for any kind of a rotary shaft application, let Garlock's experienced engineering staff work with you. Write for our Mechanical Seal booklet.

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BULLETINS just released and of immediate plant interest

ELECTRICAL

101 Plug-In Power—Plant engineers concerned with electrical installations involving portable tools, materials handling equipment, cranes and hoists, cutting and sewing equipment, will find 60-pp Catalog 25 a big help. It covers a prefabricated trolley busway electrical distribution system designed to provide outlets for power or light anywhere and everywhere along its length—a system that can be modified or extended to take care of future needs. Its features are discussed and applications pictured. Catalog includes specifications, mounting data, installation procedure and typical layouts for both 60-amp and 100-amp capacity systems. Feedrail Corp.

102 For Practical Distribution Service—A single-circuit unit substation arranged for maximum accessibility and easy maintenance is described in 8-pp Bulletin 11B-7407. Photos show how transformer, regulator and switchgear are contained in a single weatherproof enclosure. Flexibility and other features are discussed. Also described is an optional feature, a built-in circuit breaker by-pass switch. Allis-Chalmers Mfg. Co.

103 Power Centers—Bulletin B4162, 36 pp, although presenting standardized power centers utilizing both dry-type and liquid-insulated transformers, features the modern dry type, stressing their economy, safety advantages and ease of installation. Also describes and illustrates standardized switchgear incorporated in all power centers. Provides data showing how these centers serve simple radial and loop primary radial, banked secondary radial, primary and secondary selective radial, primary selective network and spot network systems. Also covers centers with high voltage switchgear, outdoor and self-contained centers. Westinghouse Electric Corp.

104 Synchronous Motor Starters—Booklet B-6378, 8 pp, describing synchronous motor control, for the operation and protection of all types of synchronous motor drives, features photos keyed to line drawings explaining how starters work and pointing out their features. Company's new Type ASR polarized slip-frequency field application relay is pictured and its operation described. This relay can be adjusted on the job. Booklet also introduces a pull-out relay to protect the motor in case it fails to synchronise or pulls out of synchronisation after being in step. Westinghouse Electric Corp.

105 Power Circuit Transformers—Bulletin 501-15, 12 pp, contains descriptive information on manufacturer's line of auto and double wound dry type power circuit transformers. Provides tips on converting old installations, isolating service, and transformer selection. Includes wiring diagrams, full dimensional data. Jefferson Electric Co.

106 Motors with Pre-Lubricated Bearings—Pre-lubricated bearing design providing increased hours of motor operating life without relubrication is the subject of illustrated Buletin B-2201, 4 pp. Contains descriptive sketches, cutaway drawings of the double shielded bearings and their bracket mounting, also check list comparing other bearing arrangements with company's design. Reliance Electric & Engineering Co.

107 Motor Starters—Twelve-pp Bulletin 14B6418A describes and illustrates motor starters for 2300 to 5000-v squirrel cage, wound rotor, synchronous and multi-speed motors. Covers advantages of control cabinet, air and oil-immersed contactors available, protection afforded by these starters, construction details and dimensions. Allis-Chalmers Mfg. Co.

108 On-the-Job Power—Titled, "Profitable Power," this 8-pp booklet pictures some of the many uses for manufacturer's power units offering up to 180 working hp. This line includes 11 models, five carburetor type and six diesels, and ratings are given for all. International Harvester Co.

109 Engineering Data on Magnetic Starters—Form G-7005, 8 pp, introduces company's Type RA line of magnetic starters and CRA line of contactors in sizes 0, 1, 2, 3 and 4. These controls—claimed to be the smallest on the market—are intended to meet requirements for reduced weight and size without sacrifice of performance. Booklet gives ratings, dimensions, design details. The Arrow-Hart & Hegeman Electric Co.

110 Plating-on-the-Job—This is a small folder describing a powder for silver plating high amperage connections on the job, to eliminate power losses and overheating without shutdown. Illustrates its use on busses, clamps and fittings; gives instructions for use, prices, coverage. The Cool-Amp Co.

111 Indicating Fuse Cutouts—Bulletin GEC-704, 8 pp, introduces a line of heavy-duty fuse cutouts of the enclosed indicating type. Describes and illustrates design and operating features of 100-amp and 200-amp cutouts as well as a 400-amp disconnect cutout. Includes dimensional and rating data on the 100-amp cutout which is priced the same as the 50-amp unit which it replaces. General Electric Co.

112 If You Use Fluorescent Lighting—Here's a bulletin announcing an inexpensive device, the Lok-Gyd, for fluorescent fixtures. It's intended to make an easier, quicker job of inserting and removing lamps and to hold them firmly while in use. Pictures show how the Lok-Gyd slips over the socket and brief text explains how the lamp can be inserted with one hand. Edison Electrical Co.

VALVES, TRAPS

113 Air Control Valve Data—A new knob-operated air control valve with die cast body, for air, water, or oil service, pressures to 175 psi and temperatures to 125 F is described and illustrated in this single-sheet bulletin. Dimensions and mounting data included. Valvair Corp.

114 Hydraulic Motor Valve—Principle of operation and construction details on a motor valve for open-and-shut control which features powerful hydraulic action and economical operation are explained and illustrated in Bulletin 1000-A. Dimensions and capacities for both single-seated and double-seated types included. Sarco Co., Inc.

115 Float and Lever Valve Chart—By reference to intended service, maximum pressure drop between inlet and outlet, maximum temperature and other factors, this handy selection chart makes it easy to choose the correct valve. Also helps determine proper size and indicates which valves are suitable for deadend service. Both this chart and Bulletin 349 on float valves are available. Klipfel Valves, Inc.

116 Hydraulic Valve Catalog—Practically all types of four-way hydraulic valves—90 models in all—are illustrated and described in 33-pp Catalog Section 302. Listings include working drawings, specifications, cutaway views, and operational diagrams of piston designs. Circuit layouts for important types of control show arrangement of all necessary hydraulic equipment and are accompanied by description of circuit operation. Catalog features company's simplified design with balanced type piston, O-rings for sealing stem and cover and large passages for unrestricted flow. Rivett Lathe & Grinder, Inc.

117 Pressure Reducing Valves—Selection and engineering data on pressure reducing valves, including those for remote control of reduced steam or water pressures, are presented in 12-pp Bulletin 477-A. Valve types are illustrated photo and sectional views. Also described and illustrated is company's desuperheater. Northern Equipment Co.

118 Small Valves for Rugged Service—Midget-size, two- and three-way packless solenoid valves for severe and frequent operating service are described in a folder comprising Bulletins 8302 and 8314. Available with brass or stainless steel bodies, these valves are for air, gas, water, light oil, refrigerants; for temperatures to 212 F. Full ordering information, including dimensions, prices and flow data, is provided. Automatic Switch Co.

119 Improved Steam Traps—Illustrated Bulletin 350 contains specifications, capacities, sizes, pressures, weights and list prices of principle types of company's super steam traps which feature simplified piping arrangements, easier accessibility, reverse flow and other advantages. Data is also provided on self-cleaning strainers and forged steam traps for higher pressures and super heated steam services. The V. D. Anderson Co.

INSTRUMENTS AND CONTROLS

120 Water Temperature Control—How to regulate the cooling water system of

December, 1950

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diesel and gasoline engines and air compressors with company's water temperature control is explained and illustrated in this bulletin. Two types of regulators and dial indicating thermometers are pictured and typical applications diagrammed. The Fenwal Regulator Co.

121 Putting the Ratio Totalizer to Work—Twelve suggested applications of company's ratio totalizer in automatic control circuits are described and illustrated by diagram in 8-pp bulletin 3450. This new device is a pneumatically operated control mechanism for combining input control pressures and spring forces to produce a single output control pressure. Applications in computing circuits include addition, subtraction, multiplication and division, averaging and reversal of loading pressure, also specialized applications. A cutaway drawing in color illustrates principles of operation. Hagan Corp.

122 Temperature Instruments—Thermocouple-actuated temperature indicators and recorders designed to meet need for sturdy and economical electrical instruments for the -100 to 3000 F range are introduced in Bulletin 404. Explains and illustrates Micromax balance principle employed in these instruments, also design features. Gives case dimensions, specifications, list prices and typical applications. Manning, Maxwell & Moore, Inc.

MATERIALS HANDLING

123 Specifications on Handling Equipment—Form TC-44 is an 8-pp condensed catalog containing basic specifications on company's entire line of materials handling equipment. Models listed include fork-lift trucks, both gas-powered and electric, on solid and pneumatic tires; industrial towing tractors; tructractor models for handling bulk materials, and 20 special attachments. Industrial Truck Div., Clark Equipment Co.

124 Fast-Working Hoists — Illustrated Bulletin WHS-5, 6 pp, provides full electrical details on company's hoists—on their wiring, brakes, motors and fast-operating, push-button control equipment. Standard, multi-speed and cut-in controls and limit switches are described. A discussion of two-speed control is accompanied by a chart showing some of the unusual speed combinations available. Hoist and Crane Div., Harnischfeger & Myers, Inc.

125 Overhead Handling—Titled, "Industry's Air Transport," 8-pp illustrated Booklet C-313 shows various types of company's high-lift hoists and describes these hoists and hoist cranes. Close-up and subassembly views show details of design and construction. Tabulated dimensional data for different capacities and spans for hoist cranes and end trucks is included, with typical installation views. Northern Engineering Works.

126 Pallet Unloader — The illustrated bulletin describes a pallet handling attachment for electric or hydraulic fork trucks. It's easily operated, requires only 4½ in. of truck space and doesn't add to truck width. Pictures show how this labor-saving device carries loaded pallet into truck or box car, then removes entire load, as a unit, from pallet, stacking as high as truck operating range permits. Blauser Machine Co.

127 For Better Conveyor Performance—This illustrated folder describes a Timken bearing troughing idler designed to increase conveyor life, cut down on maintenance and belt wear and permit handling of larger loads. Tells how idler is built for long, hard wear; gives sizes. Also describes return idlers and drive pulleys. The Conveyor Co.

FOR SPECIALIZED CONVEYING JOBS

128 Vertical Lift Conveyor—Bulletin 130 describes and pictures the Recordlift, a vertical conveyor for distributing mail, records, files and general supplies in large institutions and commercial buildings. By using this system, the operator places the material in a container, pushes a button for the proper floor and puts the container in the load opening. Standard Conveyor Co.

129 Press Room Conveyor—Form PV-58 describes a portable conveyor unit specially designed for handling metal stampings in press rooms, but also applicable to other lifting and elevating jobs. Explains design details, illustrates possible variations. Gives sizes, specifications. The Rapids-Standard Co., Inc.

130 Portable Trough Conveyors—The efficiency of portable trough conveyors in handling sharp or abrasive materials and fine or powdery materials, such as crushed stone, coal, sand, gravel, and also small bags and bundles is stressed in this 8-pp illustrated bulletin. Describes and pictures electric motor driven and gasoline engine driven models; gives specifications. Conveyor Div., A. E. Farquhar Co.

MECHANICAL POWER TRANSMISSION

131 Pillow Blocks and Bearing Units—Bulletin 56, 8 pp, provides general descriptions, illustrations and engineering data on pillow blocks and spherical, and cylindrical bearing units and hanger bearings. Gives dimensions, bearing capacities. Also discusses lubrication of the bearings, giving recommended grades of lubricants marketed by several manufacturers. W. A. Jones Foundry & Machine Co.

132 For Constant Horsepower Output—Bulletin 161 is an illustrated technical discussion of company's Hydro-Wind, a unit which combines hydraulic couplings with a set of planetary gears in such a way as to give a near-constant horsepower output when input speed is held constant. Describes construction of the unit and explains the principles of operations, providing full engineering data on a typical application. Twin Disc Clutch Co.

133 Right-Angle Enclosed — Engineering Bulletin 3110, 16 pp, illustrates and describes company's new all-steel Motoreducer with adaptable right angle head for horizontal or vertical applications and available with output shaft single or double ended. Design advantages and typical applications are covered; specifications, dimensions and selection tables included. The Falk Corp.

CONSTRUCTION MATERIALS

134 Fiberglas Bibliography—This is the new, 32-pp third edition of a volume of annotated references to selected articles on Fiberglas products which have appeared in the nation's press. Uses of Fiberglas products documented in the book include such applications as refrigerating equipment, water heaters, forced warm air furnaces, reinforced paper, reinforced hose, wire and cable, laminated shipping containers and storage batteries. Includes indexes of publications cited, authors and applications and uses. Bibliography is available without charge to plant engineers, engineering students. Owens-Corning Fiberglas Corp.

135 Hardboards and Their Uses—This 24 pp booklet on company's Presdwood and other hardboards, tabulates the different types, giving thicknesses and panel sizes available, weights, tensile strengths and resistance to chemicals. Illustrated throughout, discusses the advantages of these boards, their fabricating, bending and surface treatments. Masonite Corp.

136 For Tight Brickwork — Causes of leaky brickwork and how they can be prevented and remedied are discussed in Form O.M.4, 16-pp. Featured in this illustrated booklet are tests showing how company's cement dispersing, mortar admixture improves properties of all mortars whether job-mixed cement lime, masonry cement, or prepared mortar mixes. Among benefits described are improved workability with less water, increased water retentivity, reduced shrinkage and improved bond. The Master Builders Co.

137 More Shelves in Less Space—This 8-pp illustrated booklet presents a new type of shelving which provides more compact, accessible and economical storage of parts and material and is especially desirable for centrally-located high-cost areas and for enlarging storage capacity of existing buildings. Booklet explains advantages of the system, including extra space gained by the combination of fixed and swinging double-faced compartments. An installation is described and illustrated in detail. Snead & Co.

MAINTENANCE

138 How to Choose and Use Paint—The proper selection of paint and paint products—and ways to apply them—are covered in this 12-pp handbook. Describes products for use in industrial maintenance, public utilities, electrical manufacturing, steel fabrication applications. Contains information on applying primers and finishes to transformers, circuit breakers, transmission towers and structural steel. Spreading rate and drying times are given. Preservatives are recommended for wooden structures and fabrics such as awnings and fire hose. Waterproofing and concrete sealing coatings are also discussed. James B. Sipe and Co.

139 Metal Protector—A plastic, non-inflammable preservative for adding years to the service life of metal roofs, structural steel, ducts, stacks and other metal surfaces is described in this folder. Tells how to use this preservative, and where, giving coverage. Pierrock Co.

141 Big Little Vacuum Cleaner—Construction and operating details on a small portable vacuum cleaner incorporating

(Continued on page 53)

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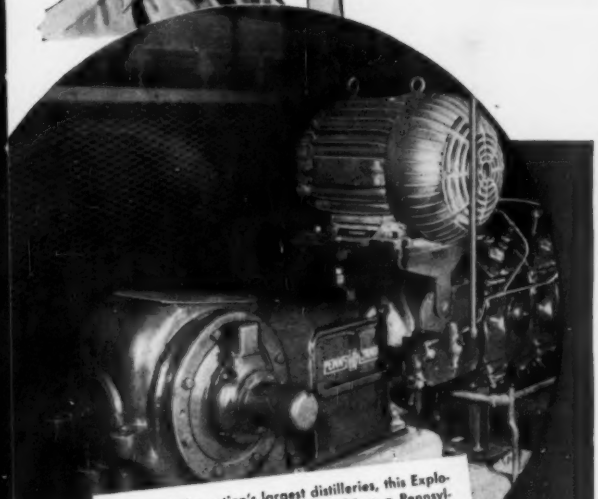
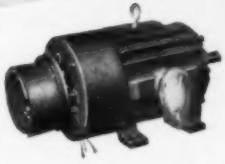
TOTALLY-ENCLOSED...FAN-COOLED MOTORS



In one of the nation's largest distilleries, this Explosion-proof SEALEDPOWER Motor drives a Pennsylvania pump and air compressor. Explosion-proof motors are specified for all drives, can then be moved from non-hazardous to hazardous services.

Now available on special order . . . SEALEDPOWER BRAKE MOTORS



Here's a combination many equipment builders have been waiting for. The new, money-saving C-W Brake, mounted with the SEALEDPOWER Motor (with suitable double shaft extension), provides a compact package of dependable, precisely-controlled power. Simple, wrap-around cover on Brake gives totally-enclosed protection. Details on request.

Dust and fumes are blown outside and away

Because there are no easily-clogged, hard-to-clean internal ventilating passages, SEALEDPOWER Motors do not have to be taken apart for cleaning. Even under extremely dirty conditions a SEALEDPOWER needs cleaning only one-third as often as other motors. Then, it can be quickly restored to full efficiency by simply removing the fan cowl, and cleaning the fan assembly.

CONTINUOUS COOL-RUNNING EFFICIENCY A SEALEDPOWER Motor runs cool, year after year, because no blanket of dust or corrosion can pile up to block escaping heat. Also, the outside fin construction, original with Crocker-Wheeler, provides 150% more cooling surface.

BEATS RUST AND CORROSION The frame of the SEALEDPOWER is rugged gray iron, for highest resistance to conditions of excessive moisture and corrosion. There is no thin steel outer shell to gradually disintegrate.

PRELUBRICATED, SEALED BEARINGS Double-row-width and packed with an extra supply of stability-tested grease, they need no attention for at least five years.

For hazardous services . . .

EXPLOSION-PROOF SEALEDPOWER MOTORS

Now, get all the advantages of SEALEDPOWER design in motors that are approved by Underwriters' Laboratories for Class I, Group D, and Class II, Group F and G locations. For use in refineries, chemical plants, grain elevators and similar hazardous services, they meet every safety requirement.

ADD THE PLUS OF SEALEDPOWER PERFORMANCE

to the other sales features of the motor-driven machines or apparatus you make. Use SEALEDPOWERS, also, on the motor-killing drives in your own plant. Compare them from every standpoint — performance at peak loads, low maintenance, and long life. There's no other motor to match them.

Available in new ratings — Standard, 3 to 100 hp . . . Explosion-proof, in NEMA frames 364-505. Send the coupon today for detailed descriptive Bulletins.

CW-14

Elliott Co., Advertising Dept., Jeannette, Pa.

Please send:

- Bulletin SL-300-2A, standard SEALEDPOWER Motors ☐
- Bulletin SL-300-5, Explosion-proof SEALEDPOWER Motors ☐
- Information on SEALEDPOWER Brake Motor ☐

(PE-1250)

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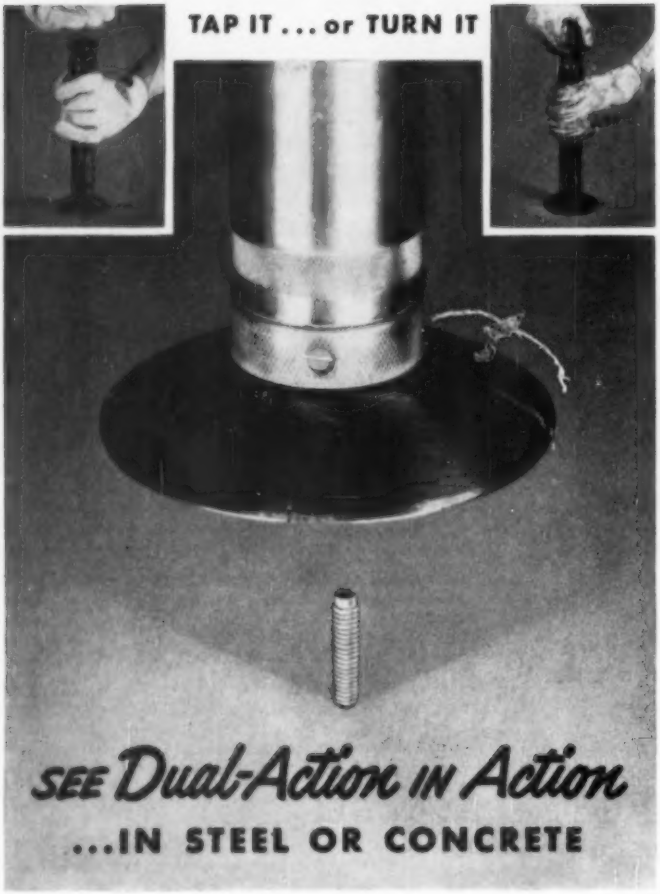
ELLIOTT COMPANY

CROCKER-WHEELER DIVISION

Ampere, N. J.

Branch Offices: Atlanta, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Houston, Kansas City, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Newark, Philadelphia, Pittsburgh, St. Louis, Salt Lake City, San Francisco, Seattle, Tulsa, Washington, Wilmington, Representatives in principal cities.

Elliott Motors larger than the Crocker-Wheeler line are built by the Ridgway Division at Ridgway, Pa.



At no cost to you, we'll do an actual fastening job for you, in steel, concrete, other building materials, with RAMSET DUAL-ACTION Fastening Tool . . . the only powder-actuated tool that offers this *dual choice* of TURN . . . or TAP . . . operation for easier, faster fastening in more locations.

We'll show you how DUAL-ACTION has more built-in stability than ever before. We'll prove also, the extra utility, extra economy of RAMSET DUAL-ACTION. Long life and dependability, too, come from precision-built, hardened steel parts, that resist continuous wear and corrosion.

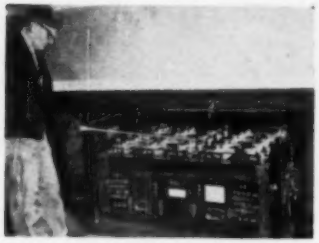
With varying strengths of powder charges, to insure correct penetration, with widest range of steel drive pins and threaded studs, and with DUAL-ACTION, you'll save time, work, money. Call your local RAMSET Specialist or write us for free sample demonstration. RAMSET FASTENERS, INC., *12117 Berea Road, Cleveland 11, Ohio.*

Ramset Fastening System
Pioneer in powder-actuated fastening

(Continued from page 16)

assembly could be rolled out from the battery box more easily than a single 4-cell tray could be skidded out, and that, after being rolled out, the battery could be inspected, cleaned and watered much more easily and quickly.

In the cradles (which roll on ball-bearing wheels) the batteries are assembled in five 5-cell trays. Since the entire assembly rolls in and out as a unit, the total length of the necessary tray-to-tray jumpers



The battery assembly is conveniently rolled out into the open where it can be easily inspected, cleaned and watered

is reduced more than half. In a 25-cell assembly, for example, approximately 64 in. of jumper cable are used; this compares to approximately 144 in. for a conventional assembly. As there is no flexure of the jumper cables in normal use, wear is also greatly reduced. *From Storage Battery Power, a publication of The Edison Storage Battery Div. of Thomas A. Edison, Inc., West Orange, N. J.*

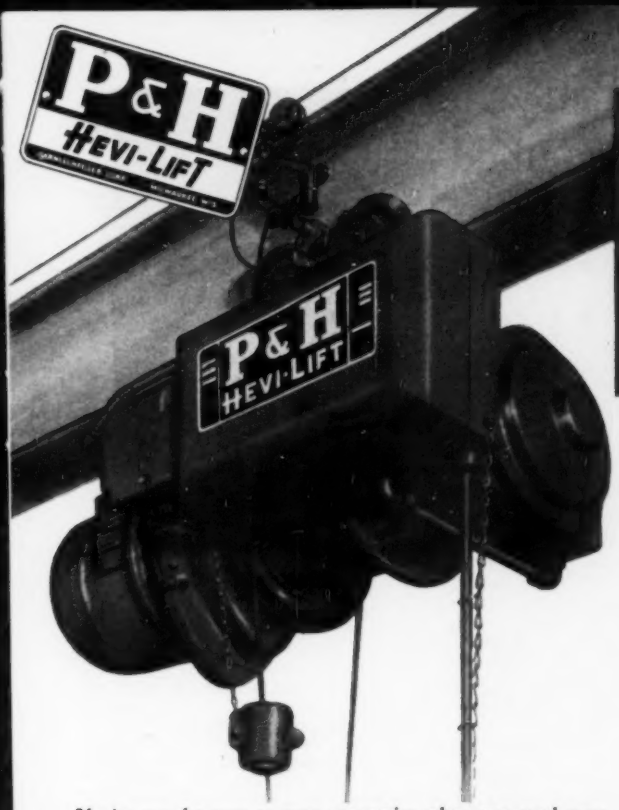
Skin-Cutting the Easy Way

THE NEED FOR a better skin-cutting method at Boeing Airplane Co. was obvious the moment skin specifications called for butted rather than lapped joints; it became imperative when the tolerances for those joints were narrowed.

It took long study and many trials to meet all the requirements, but the tool engineers finally did it and the result is a 17 lb saw that runs on a flexible steel track, its blade set with tungsten-carbide teeth and driven by a 1½ hp air motor. The steel track may be integrally fastened to a jig, or it can be wrapped on to the cylindrical surface of the B-47 fuselage and held there during a cutting operation by broad-based Neoprene suction cups.

The lateral accuracy of the saw cut is controlled by the rigidity, in that direction, of the flexible steel track. Depth of the cut is regulated by a gauging wheel whose edge rides on the skin about 1/16 in. to one side of the saw blade. This wheel turns on a bushing whose bore revolves on the sawblade shaft, but whose outside bearing surface is eccentric to that shaft.

Putting skin on the body of the



Get on the Beam...

WITH A *HEVI-LIFT* TO CUT YOUR HANDLING COSTS

You're on the way to new economies when you send your loads "thru-the-air" with a P&H Hevi-Lift. Wherever speed and frequent handling are factors, P&H Hevi-Lifts save money because *one man* does the whole job quickly and safely — by merely pressing buttons. This is the way it's done these days in thousands of locations — with all kinds of loads up to 15 tons.

Why temporize? Why delay savings the Hevi-Lift is ready to bring you *now?* The first step is to let us send you the new bulletin which shows dozens of money-saving ideas.

HANDLE IT "THRU-THE-AIR" AT LOWER COST

CAPACITIES UP TO 15 TONS

THESE ADDED VALUES ARE STANDARD EQUIPMENT ON P&H HEVI-LIFTS

The P&H Hevi-Lift is built for years of hard service—backed by America's largest builder of overhead materials handling equipment. It costs you less to have the Hevi-Lift Added Value features than to be without them.

SAFER — True motor ratings insure against failure at full capacity loads and speeds. Thermal overload protection, 110-volt control current and crane-type limit switch provide maximum safety.

LIFETIME CONSTRUCTION — Precision-built... shaved gears... grease sealed bearings... moisture, dust and acid-proof.

SMOOTHER OPERATION — Motor specifically built for frequent reversals in hoist service.

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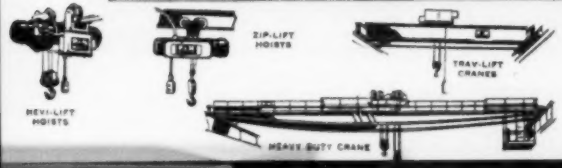

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4682 West National Avenue
Milwaukee 14, Wis.

Gentlemen: Please send your new bulletin on P&H Hevi-Lift Hoists.

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Company.....

Address.....

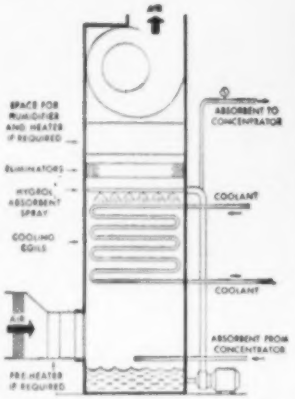
City.....**Zone**.....**State**.....

How You Save with the NEW Niagara Method of Air Conditioning

Using "Hygrol" Absorbent Liquid

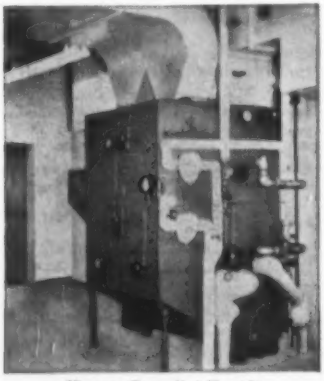
Because it absorbs moisture from the air directly, the new Niagara Controlled Humidity Method uses less, or no, mechanical refrigeration for dehumidifying. You save first costs and installing of heavy machinery. You save space, maintenance expense, power. You get easier, more convenient operation.

Using "Hygrol" hygienic absorbent liquid, this method gives complete control of temperature and relative humidity. Especially, it is a better way to obtain dry air for drying processes, packaging hygroscopic materials, preventing moisture damage to metals, and obtaining better quality for chemical process products and food products—or in obtaining better results in comfort air conditioning for office or laboratory at lower refrigeration costs.



NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

Food Packaging under Controlled Humidity


Niagara Controlled Humidity Air Conditioner

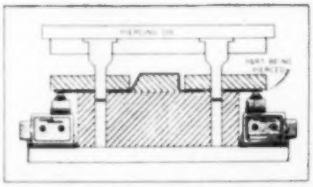
The diagram shows how filtered air is dehumidified by passing thru a spray of "Hygrol"—a liquid absorbent which removes air-borne moisture. This liquid is hygienic and non-corrosive; it contains no salts or solids to precipitate and cause maintenance troubles. It is continuously re-concentrated at the same rate at which it absorbs moisture, providing always the full capacity of the air conditioner, automatically.

Units provide a range of capacities from 1000 to 20,000 C. F. M. Multiple unit installations are in use successfully. Records of results are available. For further information, write Niagara Blower Co., Dept. PE, 405 Lexington Ave., New York 17, N. Y.

Flexible steel track holds tightly to skin. Depth of saw cut does not depend on track; it is ganged micrometrically by eccentric wheel alongside the saw

B-47, then, goes like this: the first sheet is riveted on completely and permanently, the saw is run around the edges, and the waste strips are torn off. The second sheet is then put in place, its edge lapping slightly over the first sheet. The second sheet is riveted back from the edge of the first sheet a few inches. The saw is then set over the second sheet, along the lapped edge. After the saw cut is made in the second sheet, the waste portion is torn off and the edge of the second sheet snaps down into place, butted snugly against the edge of the first sheet. Riveting on the second sheet is then completed and all its edges are sawed. As rivets are driven along the butted edge, the skin is expanded slightly and is thus drive fitted to the edge of the first sheet usually to zero tolerance. *From an article by Louis R. Huber, in Boeing Magazine, a publication of Boeing Airplane Co., Seattle, Wash.*

Safety Device for Punch Press

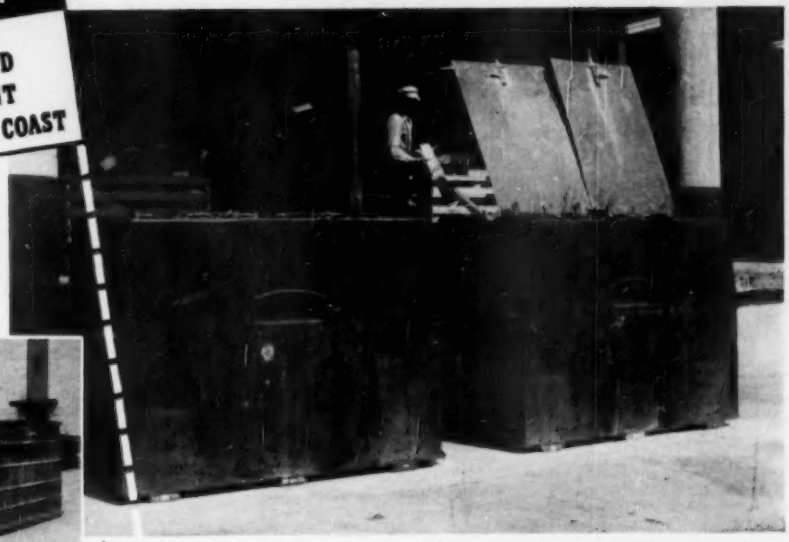

Two snap-action switches were incorporated in this piercing die to insure softer operation of punch press. The foot controlled press cannot operate until the part is exactly located in the die, with the actuators of both snap-action switches touched by the part to be pierced. The switches are wired in series, between the foot control switch and the press power unit. (From Charles A. Haugk, in Micro Tips, a publication of Micro Switch, Freeport)

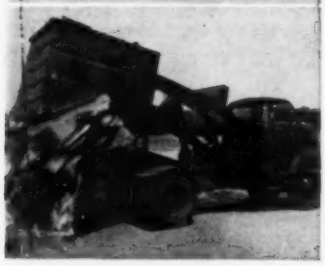
★

DEMPSTER DUMPSTER SYSTEM

SERVING COST-MINDED MANAGEMENT FROM COAST TO COAST

. . . handling bulk materials of every description at phenomenal savings





★

CPP — COLGATE-PALMOLIVE-PEET CO. — QUALITY PRODUCTS SINCE 1806

—recognized across the nation

. . . Colgate-Palmolive-Peet Company, well known for sound management, uses the Dempster-Dumpster System.

Colgate-Palmolive-Peet Company is among the hundreds of well managed manufacturers, both large and small, who use the Dempster-Dumpster System of bulk materials handling . . . the system recognized across the nation for its efficiency and ability to reduce costs.

You will cut cost of equipment and operation . . . you will eliminate standing idle time . . . you will eliminate re-handling of materials . . . and you will increase efficiency and good "housekeeping" by installing the Dempster-Dumpster System in your plant now! In this system, one truck-mounted Dempster-Dumpster services any required number of detachable containers—and each suited to the particular materials handled—be they bulky, light or heavy . . . solids, liquids or dust . . . trash or rubbish. Large photo above shows how containers are placed at convenient materials accumulation points and are preloaded, in this case, with waste materials. With only one man, the driver, the truck-mounted Dempster-Dumpster picks-up, hauls and dumps one pre-loaded container after another, as illustrated in three photos at left. It will pay you to investigate the Dempster-Dumpster System now! A product of Dempster Brothers, Inc.

One Dempster-Dumpster Services All Containers. . . All Designs. . . All Sizes

DEMPSTER BROTHERS • 1120 Shea Building • Knoxville 17, Tennessee

MAINTENANCE & OPERATION

of buildings, utilities and facilities

Pay Check Inserts Promote Safety

Contributed by Fred G. Hess
Asst. Plant Eng., Camden Forge Co.

At the Camden Forge Co. pertinent safety messages are frequently attached to the stub of the check. The blueprinted announcements are 8 in. long, folded to conform with

NOTICE TO BRAKEMEN
AND RR CAR HANDLERS
THE BRAKEMAN MUST ALWAYS PRECEDE A DRAFT OF CARS INTO ANY SHOP
WHEN A CAR IS UNCOUPLED AT ANY POINT, IT MUST BE SAFETY CHOCKED TO PREVENT DRIFTING
ALL SAFETY CHAINS MUST BE ATTACHED BEFORE MOVING ANY CAR
YOUR SAFETY COMMITTEE
MAKE EVERY DAY A SAFE DAY

A recent pay check insert directed at company brakemen and car handlers

the stub and are stapled to it. The notices emanate from the safety committee and are addressed to a given group of employees to instruct them or remind them of safety practices peculiar to their job.

Induction Heater Cuts Costs

Contributed by General Electric Co.

One of the large engine valve manufacturing organizations recently reduced valve-tip hardening costs with a 20 kw GE induction heater.

The Thompson Products Co. had been using an oxy-acetylene torch with an automatic chain conveyor belt. In this operation, the valve was set in water with the tip protruding above the water line. Torches were locked into position and the valves were indexed in line for heat treating by means of the conveyor belt.

Now, variables in the heat-treated product encountered with the previous equipment have been eliminated since input and time under heat can be exactly controlled. Thus more consistent heating, hardness and hardness depth in treated valves have been obtained plus the fact that production costs per item have been reduced 30 per cent.

Quick Test Eliminates Defects In Brazing

It has been the experience of many metal fabricators that certain lots of metal, due to some inherent variations, do not draw, bend or join as easily as others. These inherent variations may reflect the presence of very minute quantities of impurities, the detection of which require elaborate testing equipment. However, a quick and reliable test has been developed by The Riverside Metal Company, Riverside, N. J., for determining the brazability of its cupro nickel alloys.

Several years ago, an Eastern manufacturer of heat exchangers periodically had its production line shut down due to defective brazing

Coupon at top is rejected because of dullness of surface; the sample at the bottom is okayed for brazing operations

of the heat exchanger joints. The exchangers were being delivered from the furnace with the brazing metal and parent metal unjoined.

The usual physical and chemical tests disclosed no clues as to why a particular heat of cupro nickel could not be brazed satisfactorily. Riverside then sought a method of testing each heat to determine its brazability. The following test procedure, which consistently detected the non-brazable heats, was set up.

During the casting of each heat, a test coupon or sample of the metal is taken for determining brazability.

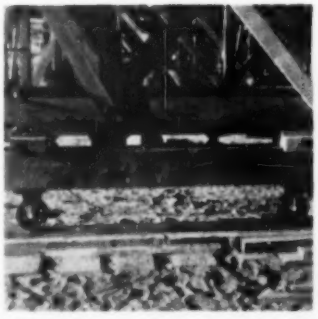
The test coupon is taken immediately to the laboratory rolling mill where it is reduced to a thinner gauge. These latter test pieces are then put into a furnace and held for 15 minutes at 2050 F. in order to duplicate the time, temperature and

Scaffold Moved on Casters to Save Time, Money

Contributed by The Bamick Company

Instead of building a complete scaffold for erecting the Denver Municipal Auditorium, the contractors, Swinerton & Walberg, constructed just one section, and equipped it with heavy-duty casters. Angle iron tracks were then laid upon which the scaffold could be moved. This eliminated costly erecting and tearing down of separate scaffolds for each roof section.

The new method was simple to operate, too. The scaffold-on-wheels supported forms for the roof which were built under each roof section to be poured. The forms were raised by hydraulic jacks to roof height and the section was poured. After the section was set, the forms were lowered by the jacks and the scaffold moved about 40 ft.



Grooved-wheel casters mounted on angle iron tracks support the heavy scaffold and permit an easy movement

After a section of the roof has been poured the scaffold is easily rolled on angle iron track to the next position

Plug in "ON-THE-SPOT" POWER
. . . move machines anywhere, any time

ELECTRICIAN tapping *live power*, without slowing down production, by simply inserting a protective plug in BullDog "Plug-In" BUStribution DUCT.

Put extra profits in your production line with flexible BullDog BUStribution DUCT

HERE'S THE electrical distribution system that's right in step with your modern, expanding production facilities.

With BullDog "Plug-In" BUStribution DUCT, you can tap *live power* where you want it, when you want it. To move a machine, simply remove from the duct the plug that is feeding it electrical power. Move plug and machine to new location, and insert the plug in a convenient duct outlet.

It's as simple as that! Costly rewiring and expensive shutdowns of other machines are eliminated once and for all!

Your savings are threefold with flexible BullDog "Plug-In" BUStribution DUCT. Initial cost is low . . . practically no maintenance is required . . . safety and flexibility are at a maximum. Like all BullDog BUStribution systems, "Plug-In" DUCT is completely salvable . . . right down to the last nut and bolt.

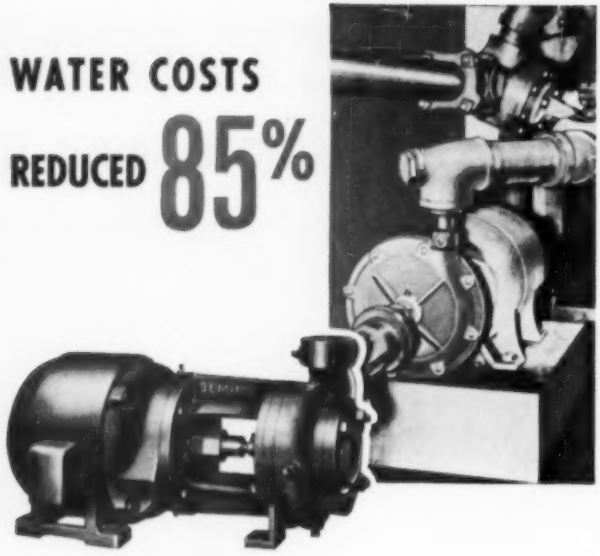
Call your local BullDog Field Engineer soon for full information. He will be glad to show you an installation near your own plant.

BULLDOG ELECTRIC PRODUCTS COMPANY
DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES
IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO

BULLDOG

PIONEERS IN FLEXIBLE ELECTRICAL DISTRIBUTION SYSTEMS

WATER COSTS REDUCED 85%



with a DEMING motor-mount pump

Water was costing a small manufacturer $900.00 a year. A salesman of a Deming Distributor suggested a checkup on costs of drilling a well and installing a Deming Pump. The results were as follows:

Installation Costs

$400.00 cost of well
400.00 cost of pump and storage tank*
$800.00 total cost of installation

*The pump installed is a 7½ H.P. Deming "Motor-Mount" unit delivering 50 GPM at 95 lbs. pressure. The tank is 500 gallon capacity.

Operating Costs

The plant uses a daily average of 20,000 gallons of water. Cost of electricity at .017¢ per KWH for the Deming Pump averages 52¢ per day.

$135.00 is cost of electricity per 260 work days
900.00 is former cost of water per 260 work days
$765.00 is annual saving on water costs

Deming Motor-Mount Pumps

The complete line of Deming MOTOR-MOUNT pumps includes vertical and horizontal types covering a wide range of capacities from 5 to 650 gallons per minute against heads up to 230 ft.

Complete details about Deming MOTOR-MOUNT Centrifugal Pumps are available in BULLETINS 4304 and 4350. Write for free copies.

THE DEMING COMPANY
532 BROADWAY • SALEM, OHIO

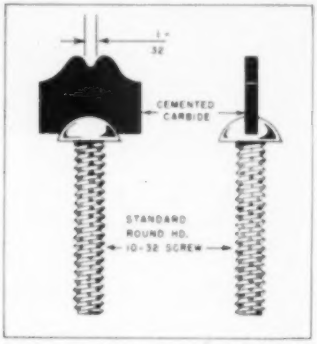
DEMING MOTOR MOUNT PUMPS

atmosphere conditions of actual brazing.

After the sample is removed from the furnace, its surface is examined visually. If the surface is bright, the heat is acceptable. If the surface is dull, then the heat is rejected for heat exchanger stock and diverted to some other application that requires no brazing during its fabrication.

Small End Mills Made from Screws

An ingenious and simple idea for producing small end mills was worked out recently in the Small and Medium Motor Divisions of the General Electric Company. The mills are made of standard Carboloy



Carbide blanks are brazed into the slot of round head screw to make end mills

883 blanks simply brazed into the slot in the head of 10-32 round head screw. The blanks are then ground to shape and the end mill is finished. The mills are used for machining oil grooves in sleeve bearings.

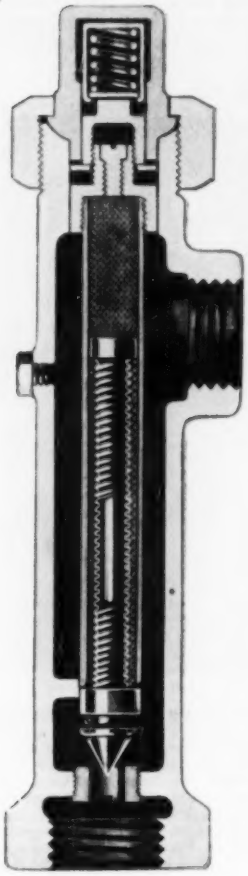
A Sure Fire Method of Whipping The Fuse Replacement Problem

Contributed by C. W. Felter

Our plant runs around the clock 6 days per week. Often workers not in the electrical department replace a burned out fuse. Few of these people have any appreciation of the importance of sizes and most of them want to put in the largest one that will fit the clips.

To overcome this difficulty, I removed all the ampere markings from our renewable cartage fuses and set up a color code which is known only to our electrical employees. A painted band around the fuse indicates the size.

When a fuse blows it need only be replaced by one of the same color. This also gives me a chance for a quick look over to check fusing as I



The Steam Trap of 100 Uses

On Outdoor Heat Exchangers

When steam heated equipment is too far away to permit returning of condensate to the boiler, Steam Trapping presents special problems.

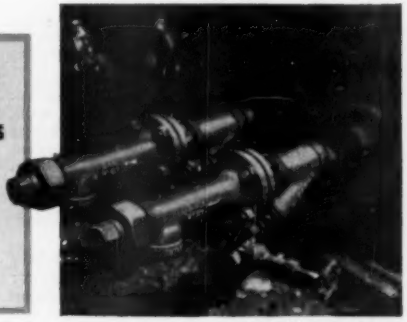
Special protection is necessary against freeze-ups in winter when equipment is out-of-doors. In every case there is considerable steam waste from re-evaporation when hot condensate is discharged to atmosphere by ordinary traps.

The Sarco Liquid Expansion Steam Trap No. 87 discharges condensate to atmosphere at temperatures never exceeding 212°F. so that there can be no heat loss from flash steam. No protection is required against freezing. A special model is available for fitting on mechanical traps. It can be set to discharge at any desired temperature down to 40°F. minimum. This is known as the Sarco Thermic Drain. Ask for Catalogs No. 250 and 550.

SARCO No. 87 TRAP

FOR

- BULK STATION TANKS
- DOCKS AND PIERS
- INSTRUMENT CABINETS
- OUTDOOR STEAM EQUIPMENT
- PIPE LINE HEATERS
- TANKERS AND TUGS
- TRACER LINES



On Oil Storage Tanks

324

SARCO SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 8, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

GET EXTRA PROTECTION —SAVE TIME AND MONEY WITH R&M "All-Weather" Motors

What causes premature motor failure? All too often, it's *moisture!* And *condensation* within the shell can be just as bad as a cloudburst. Moisture deteriorates even the best insulation—attacks all exposed metal parts—but the damage it does *can't bother you* when you specify "R & M Motors."

WON'T RUST OR CORRODE . . . All *standard* R & M Integral Motors are now entirely "Weatherized"—completely protected, inside and out, at *no extra cost* to the buyer. They're shielded from harmful dampness by special preventive treatments that cut down maintenance, add service life, improve *overall* motor performance.

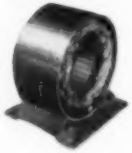
CLEAN AND COOL-RUNNING . . . You can install All-Weather Motors outdoors, without a cover—in dusty or humid locations *—anywhere!* Pre-lubricated, fully sealed ball bearings (adopted by R & M in 1939), go *years* without attention. "Clean-Sweep" *end-to-end* ventilation keeps these durable motors internally clean and cool-running.

MANY EXTRAS . . . Only Robbins & Myers gives you so many fine "extras" at the *standard* motor price. Get all the facts on All-Weather Motors today. Write for Bulletin No. 400. Please specify service or motor type. Address Dept. J-120.

ROTOR

Finished rotor is sprayed with a special rust-inhibitor which covers armature, shaft, and cadmium-plated fan used on smaller motor sizes. Larger motors have aluminum fans.

STEEL PARTS



Complete assembly of body and shell, with the stator, is dipped in "Robbinite," and this moisture-resisting undercoating—developed by Robbins & Myers—is then baked on.

CAST IRON PARTS

End-hoods and terminal box are carefully cleaned and given the same anti-corrosion treatment frequently specified by our Armed Forces for use in damp climates. Painting follows.

●

Terminal box is gasketed. Leadins are sealed against leakage at shell. Repellent grease on shaft keeps moisture away from bearings. Shrouded end-hoods give full-height protection.

ROBBINS & MYERS • INC.

SPRINGFIELD 99, OHIO • BRANTFORD, ONTARIO

MOTORS • HOISTS • CRANES • FANS • MOYNO PUMPS

go around the plant. Also it helps to keep fuses separate in the stock room as they are easily identified.

Reel Air Lift

Photo: Westinghouse Electric Corp.

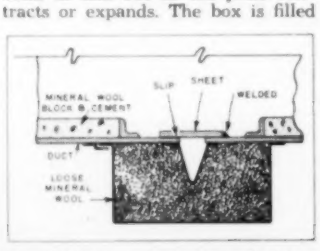
Reels of magnet wire, some weighing as much as 300 lb, are handled by means of a ¼ ton hoist and a fiber belt sling at the Westinghouse Maintenance and Repair Shop in Chicago. Stored in racks next to the coil winding department, the reels are delivered to the winding machine reel rack properly suspended by the sling for placement

Insulate Expansion Joints to Cut Heat Loss

Contributed by
Industrial Mineral Wool Institute

TO PREVENT HEAT loss at expansion joints of ducting, Public Service E. and G. Co. of N. J. has devised a simple insulating technique which it is now using at its Sewaren plant.

This comprises the construction of a light-gage metal box over the joint as illustrated. One edge of the box is so constructed that it can bend in and out as the joint contracts or expands. The box is filled

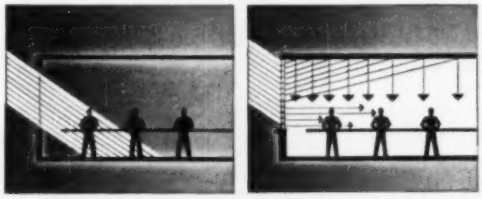


Here the joint enclosure is applied to a duct insulated with mineral wool blocks

Window maintenance problems are virtually ended once Insulux is in—no painting, no rust or rot, no shades, no harmful glare—just plenty of free, natural, comfortable daylight.

Daylight is free . . . use more of it through Daylight Engineering

The problem of daylighting industrial areas can be solved by the selection of the proper Insulux Fenestration System. No longer is it necessary to paint out or shade glass areas in your plant to control glare. Light control through Daylight Engineering with Insulux light-directing glass block makes it possible to use the *entire* glass area for the transmission of light.



Direct sun causes uncomfortable brightness near windows, extreme contrast in other parts of room. Insulux Fenestration directs and spreads part of the daylight to the ceiling—diffuses the balance, keeps brightness at comfortable levels.

New Insulux Glass Blocks Numbers 363 and 365 reduce the necessity for careful orientation of glass areas because they control light so efficiently that they virtually *"turn your building with the sun."*

Over and above daylight control other advantages in the use of Insulux Glass Block are:

(1) They are permanent; they do not rust or rot.
(2) They have a high insulation value.
(3) They are immediately available.

Daylight is free—Don't abuse it—Use It. Ask for the services of a Daylight Engineer to help you solve your daylighting problems. Just call, or write: Daylight Engineering Laboratory, Department P.E. 12 Box 1035, Toledo 1, Ohio. *Insulux Division, American Structural Products Company, subsidiary of Owens-Illinois Glass Company.*

INSULUX GLASS BLOCK

INSULUX FENESTRATION SYSTEMS

—— by the pioneers of Daylight Engineering

We shipped the three big fellows shown above to a steel plant — installed in a large building containing gas engines generating electricity. The fans provide ventilation by diluting the escaping toxic gas fumes to such a low concentration that workers' health and comfort are no longer impaired. Each of these Clarage Type W Fans handles 150,000 cubic feet of fresh air per minute at 2" static pressure — each driven by a 100 HP motor *in continuous operation.*

300 to 4000 CFM

Or perhaps you need small fans — for ventilation, for removing excess heat, smoke, odors, or more special applications. Clarage Cast Iron Exhausters can be your economical answer to such requirements. Built with cast iron housings, they *offer long resistance to corrosion.* Many have seen more than 25 years of service — and still going strong!

When you buy Clarage air handling and conditioning equipment, you buy the best. *We don't go in for flimsy, light weight constructions.* Clarage equipment — from our smallest sizes to the largest fans we build — is HEAVY-DUTY to save you a great many dollars in the long run.

CLARAGE FAN COMPANY—*Kalamazoo, Michigan*

CLARAGE

—HEADQUARTERS for Air Handling and Conditioning Equipment

SEE OUR CATALOG IN SWEET'S

It pays to direct fan inquiries our way . . . phone Clarage office in your city, or write us at Kalamazoo.

Application Engineering Offices in All Principal Cities

with loose mineral wool to prevent heat loss. Depth of the box depends on the temperature of the duct.

Public Service insulates its ducts both internally and externally, depending on duct service and applies this expansion joint covering in both cases. The box, of course, circumscribes the complete perimeter of the duct.

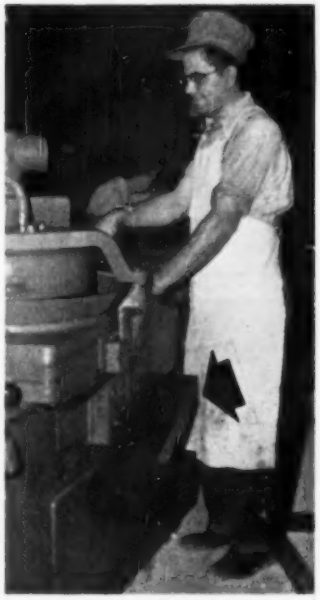
94½ Pints of Oil Saved Per Day

Contributed by
The Maytag Company

THE OPERATOR of a battery of Gleason Gear Cutters at The Maytag Company, Newton, Iowa, had long been annoyed by the oil which splashed from the machines on to the floor and also on his clothing. Consequently, Robert McConeghey did something about it and came up with the special oil shield tray shown in the photograph.

By installing these special trays on each of the nine gear cutters so that the oil runs back into the machine, loss of oil is reduced. Another advantage is reduction in use of absorbent material which formerly was scattered on the floor to keep it dry.

Maytag is now saving approximately $194.00 per year as a result of Mr. McConeghey's suggestion. He was paid an award by the company in compliance with an established Idea Plan.



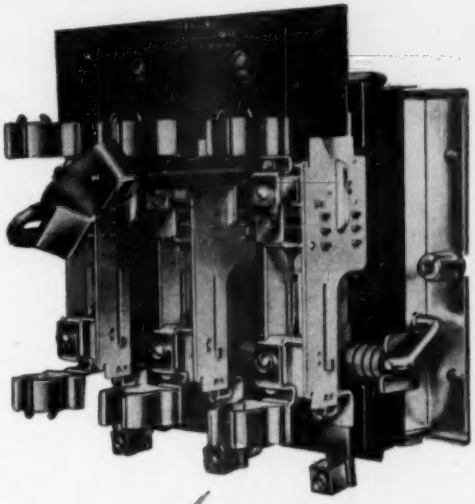
Robert McConeghey operates his machine while the tray at his knee collects the excess oil which formerly sprayed all over his clothes and onto the floor

NOW...an ALL-NEW Type A Safety Switch for modern high-capacity distribution systems...

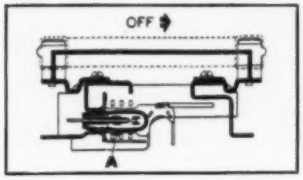
TRUMBULL'S HCI

HIGH CAPACITY INTERRUPTER

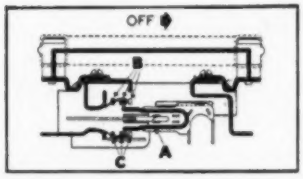
Unusually high interrupting capacity..."circuit-breaker" action breaks heavy loads quickly, safely. Extremely high momentary current capacity . . . withstands heavy short circuits without damage. 30-, 60-, 100-ampere sizes.



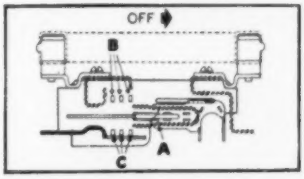
Here's How...
HCI's "Circuit-Breaker" Action Works



1. Switch closed. Spring-loaded sliding contact (A) fully inserted between stationary contacts. Heavy line is current.



2. Sliding contact being withdrawn. The two arcs repel each other, are drawn against grid pins (B) and (C), which break and cool them.



3. Contact fully withdrawn. Trumbull's unique "Circuit-Breaker" action has effectively extinguished the arcs.

CHECK THESE ADDITIONAL SPACE-SAVING, TROUBLE-PREVENTING, LIFE-LENGTHENING FEATURES

Center-front operation permits close ganging.

Front fusing allows compact box, yet gives ample wiring space.

No exposed live parts when switch is OFF and door is open.

Handle interlock.

Clear ON and OFF markings both inside and outside.

No dead center—roller-cam action (multiplying linkage design with powerful spring) throws switch to full OFF and ON.

Poles are self-contained switching units for easy replacement.

Silver-plated current-carrying parts prevent oxidation . . . give low-resistance contact.

Insulating parts made of linen melamene, light, strong, arc-resisting.

Enclosed operating mechanism (on 60- and 100-amp. sizes) prevents wire chafing.

Interior removable for wiring ease.

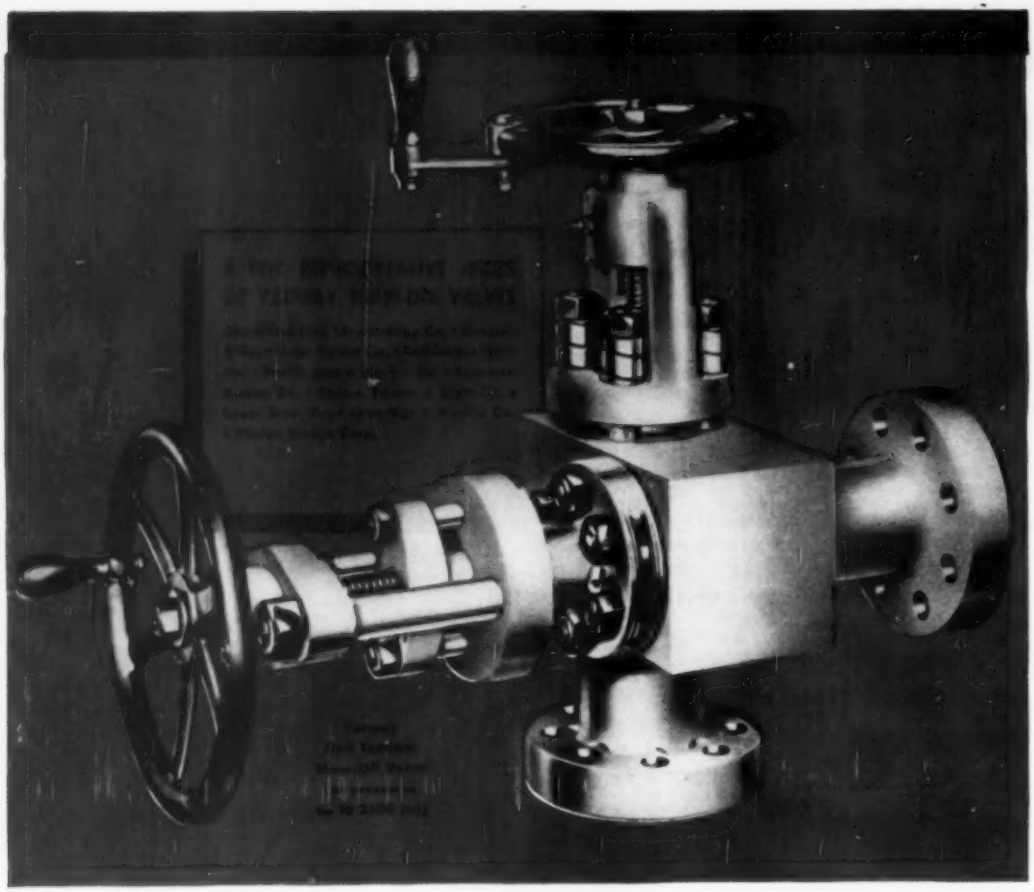
Underwriters' approval throughout.

For more information about Trumbull's all-new HCI Safety Switch, write for your free copy of Bulletin TEC-10 today. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Connecticut.

Men Who Observe the Best Electrical Practice Make It a Practice to Use

TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS



TIGHT! STRONG! for even toughest blow-down requirements

The Yarway Unit Tandem Blow-Off Valve meets the most demanding requirements for boiler blow-down or drain service.

It's drop-tight—and rugged enough to withstand the severe punishment of regular or emergency blow-down under pressure, or periodic acid wash.

Two Yarway Stellite-Seat Hard-Seat Valves or a Hard-Seat (blowing) and Seatless (sealing) Valve are combined in a one-piece forged-steel body. Designed for pressures up to 2500 psi.

It is significant that more than 4 out of 5 high pressure boiler plants use Yarway Blow-Off Valves.

For more facts, see Yarway Bulletin B-432.

YARNALL-WARING COMPANY
145 Mermaid Avenue, Philadelphia 18, Pa.

Branch Offices in Principal Cities

YARWAY **BLOW-OFF VALVES**

Rochester Plant Engineers Club Informal and Active

September meeting crystalizes club policy—Informal organization with round table discussion programs . . . Limited expansion with membership confined to plant engineers having comparable responsibilities and problems in diversified industries . . . Program topics . . . Trends in plant engineering organization . . . Increased work load due to war conditions . . . Budget practice anl control . . . Paper work procedures . . . Burden rates and charging work done to manufacturing departments . . . Overhead duct work vs. underground exhaust

CONTINUED AND growing interest in Plant Engineers' Clubs throughout the country is tangible evidence that this movement is in response to a very definite need.

Most plant engineers hold registered professional status in the state and belong to one or more professional societies. These national societies serve a useful purpose. None, however, covers the range of a plant engineer's activities, nor are they close to his personal problems. These problems are transient, usually of immediate importance and frequently influenced by local conditions.

This fact is probably the primary factor in the success of the informal club groups. The club is, in effect, a local board of consultants, men with years of experience and familiar with local conditions. In a small closely knit group, men are willing to contribute ideas on a give and take basis and with assurance that confidence will not be violated.

The greatest need for clubs of this kind appears to be in the larger metropolitan centers. There is less opportunity of cultivating the acquaintance of men in the same line of work, too many people, too many plants, too many things to do, to build up the confidence essential to free discussion of problems or to ask for or proffer advice.

That clubs can serve a useful purpose in cities of from a third to half a million population, however, is shown by the successful launching of the Plant Engineers Club of Rochester this summer.

As with other clubs, preliminary meetings demonstrated clearly the need for and advantages of such an organization. A meeting was arranged September 28 to form a more permanent organization and determine club policies. Richard H. Morris, Editor of Plant Engineering, was invited to tell of other clubs, how they are organized and operated, the nature of their activities and types of programs held.

Consideration of these, in relation to local needs, led to formation of the following general policies: The organization will be informal; meetings will be operated on a pay-as-you-go basis; membership will be limited to plant engineers of comparable responsibilities in diversified industries; the size of the club will be increased very slowly; and for the present, meetings will be of the round table or discussion group type as the most profitable under present stress of war conditions.

Many of the subjects discussed at the meeting were of a confidential nature, dealing with specific problems or practices and of little general interest. Space permits only a brief resume of some of the more general topics touched upon.

Overhead exhaust pipes are frequently a problem. One engineer, faced with a buffing wheel department rearrangement where a new floor is involved, is seriously considering placing all exhaust duct in the floor. Flexibility to take care of changes is still a problem to be whipped.

Another recently completed a plating installation using all underground exhausts. Tanks and tunnels are brick lined with a heavy coating of Bitumastic. The service record is good but the coating should be heavy and uniform.

Acid-proof tile floors? Highly successful. The ensuing discussion covered the defects and advantages of a number of recent plating installations visited by members prior to changes in their own plant.

Records and paper work are important but unless used and controlled, can be an expensive luxury. A brief exploration of this topic indicated more or less agreement on practices, allowing for deviations to meet specific needs.

More controversial, and of course less susceptible to change because it is tied in with the company accounting practice, is the method of charging manufacturing departments for work done by the plant engineering department. Practice varies, no charge but an over-all budget limitation, direct labor charge only and direct labor plus an overhead charge.

One company reported an effective curb on department demands for more space — a facility and utility charge against the department overhead levied on a square foot basis.

An incentive system for maintenance crews is of general interest but has been worked out and put into effect by few companies. The advantages and disadvantages of such a system that has been in operation 2 yr was reviewed. Can it be applied to supervision? The consensus was no, an opinion which we believe is open to question, although it is more involved and more difficult to work out equitably.

Charter members of the Plant Engineers Club of Rochester at the University Club, September 28, left to right: A. F. LAMBERTON, Taylor Instrument Companies; E. F. VANDENBERGH, Ritter Co.; H. D. GREENFIELD, General Railway Signal Co.; E. J. McGUIRE, Shuron Optical Co.; RICHARD H. MORRIS, Editor, Plant Engineering; and FLOYD KIRKHAM, Camera Works, Eastman Kodak Co. Two other members, ARTHUR MATTHIES, Gleason Works, and HADLEY L. YOUNG, Graflex, Inc., were not present when the picture was taken

PLANT PROTECTION
Is Your Problem in Civil Defense

Prepared especially for Plant Engineering by this outstanding authority on Civil Defense, this article sounds a warning for all plant management. Should hostilities in Korea cease tomorrow the real foe has been untouched; if anything, he has been strengthened militarily. We cannot relax our vigilance. Upon the shoulders of the plant engineering section falls responsibility for physical protection of the facilities and utilities. They must protect the heart and muscles of the country that may, once again, become the sole remaining Arsenal of Freedom

By **FRANK V. MARTINEK**, Asst. Vice-President
Standard Oil Company of Indiana, Chicago

A CITY IS UNDER enemy attack . . . Parachutists are dropping on airports . . . Within the city saboteurs and terrorists, armed with their blueprints of death, are executing their work by destroying communication and transportation, taking over police and fire departments and other civil activities . . . Then start exterminations . . . Destruction of churches and schools . . . Able-bodied men bury the dead and others are worked to death in prison camps.

Is this fantasy the imagination of an addled brain? No, it is possible and can happen here. Warsaw, Rotterdam, Coventry and other cities in World War II were testing grounds for what can and will happen here if we are not prepared, only devastation from atom bombs and bacteria will be far worse. Once this invisible army attacks with its vicious plan of terror, we would be helpless.

This is not a very pleasant picture to contemplate, but it could happen here. However, there is an antidote and that is, first, we must recognize the danger, make a survey of our weaknesses and then prepare to offset them.

We definitely know from authoritative sources that enemies within the United States even now are preparing to disrupt defense production through sabotage, espionage and other subversive activities.

When our forces pursued the enemy over the 38th parallel, and the Korean War appeared to be at an end, pressures for defense, protection and security waned. Business men, who were jolted out of their chairs by the frightening description of what might happen to their plants from atom bombs, lost interest as the war clouds receded. Today, that has changed. Once more, as tens of thousands of well-armed Chinese communists pour into Korea from Manchuria, it demonstrates the futility of wishful thinking that the danger is past.

Never has it been more necessary for industry and business to continue its planning to protect plants and their personnel than today. We cannot risk the possibility of atomic bomb attacks and bacteria rained from the skies upon our industrial centers. We cannot risk the possibility of espionage and sabotage and must be ever on the alert and continue protection of our vital interests.

Dangers continue to surround us. Along with these awesome and obvious dangers of atomic bombs and bacteria being rained upon the populace, there are many other perils far more insidious. There is the peril of sabotage; the mechanical sort and the psychological variety with subversive activities added in full measure.

Only the most determined efforts by management can allay these grim and real possibilities by being prepared. We, in American industry, must be prepared for an eventuality because there will continue to be wars unless selfishness, greed and intolerance and living by the code of I, me and mine are replaced by mutual understanding, faith and fraternal helpfulness. In the absence of this, there is only one thing to do and that is to develop our na-

About the Author

To people in the oil industry Mr. Martinek is known as a dynamic executive of 25 years' experience. Oil men also know him for his detection and exposure of gasoline tax racketeering; he is chairman of the Central and Illinois Gasoline Tax Evasion Committee.

Government people know him as a former FBI special agent and as present chairman of Chicago's Civil Defense Area Plant Protection Committee. He has recently been appointed a member of the National Committee.

To the general public he is best known as author of the newspaper adventure strip, "Don Winslow of the Navy." In this strip Mr. Martinek displayed his knowledge gained as Fleet Intelligence Officer of the Navy's Asiatic Fleet in World War I by predicting, accurately and in detail, the Japanese sneak attack on Pearl Harbor. He was formerly copy boy on a newspaper and can talk shop with policemen because he once set up a scientific crime detection school in Chicago and was one of the country's first fingerprint experts.

Plant Engineering knows of few men so well qualified to write on the subject of plant protection.

tional industrial strength and patriotic fervor to make certain that it does not happen here.

In addition to rigorous guard systems, with check points at the gates, restriction of movement within the plant and thorough checking of vehicular traffic for possible explosives, we must have an unending surveillance over communciations, fire protection apparatus and water systems. Floodlighting and fence screening must be considered paramount. Careful investigation and screening of employees, burning or shredding classified waste paper, keeping vital documents under lock and key, cooperation with federal and local authorities and maintenance of a file of employees' fingerprints must be considered.

Defense plants should set up plant control centers and appoint security officers. In other words, it's better to be safe than sorry. Even though we don't anticipate a gruesome event of atom bombs dropping in the United States and because of the absence of bullets in our peaceful pursuits, we must not be caught with our plants down.

Saboteurs may be divided into the following: Saboteurs who do their nefarious work in two ways, on foreign and domestic soil by: 1. Mechanical methods; 2. Psychological means.

Mechanical Sabotage

Their targets in mechanical sabotage are: a. Vital material resources; b. Communication facilities; c. Transportation facilities; d. Industrial facilities; e. Food and drinking water through contamination and pollution; f. Plants manufacturing war material; g. Manpower and womanpower.

Psychological Sabotage

Saboteurs achieve their psychological aims in the following ways: a. Undermining morale and creating dissension in order to weaken or destroy the spirit of those responsible for the free flow of supplies to military units in time of war or national emergency; b. Warping public opinion; c. Fomenting fear, doubt, and worry; d. Creating disunity; e. Making unsuspecting persons unwittingly the instruments of enemy operations; f. Causing unrest and consequent loss of man-hours; g. Spreading propaganda—false and traitorous rumors.

Foreign and Domestic Operations

Saboteurs, engaged in their own specialized kind of internal warfare, mechanical and psychological, carry on their undercover work continually at home and abroad. In other words, their field of operations is both domestic and foreign, some of it unorganized, but most of it highly organized.

What is espionage? Briefly, it is —a. Unlawful obtaining or transmitting of defense or war information; b. Unlawful disclosure of information affecting national defense; c. Photographing or sketching defense installations or equipment.

Administrative Protection Against Espionage

Protection of all classified, secret, confidential, or restricted information is one of the vitally important duties of civilian defense officers.

Keys and safe combinations must be issued only to a limited number of trusted employees.

Waste paper must be disposed of by burning or shredding.

Guards, watchmen, patrolmen, janitors, and charwomen should be examined and checked closely at all times.

Reports of any suspicious actions must be given to the department head or supervisor and then transmitted through proper channels to governmental agencies.

Spy Activities

Intensive effort should be made to prevent infiltration of spies into plants. Members of the managerial staffs of industrial organizations must be alerted to the ways in which spies conduct their operations, such as: a. Obtaining admission as privileged visitors or inspectors through impersonations, and through other fraudulent means. b. Purchasing information from employees; c. Stealing or purchasing plans, specifications, and other confidential documents.

Employees should be told frankly that they may be inconvenienced by rules and regulations designed to trap or thwart spies, saboteurs and subversives. They should be kept informed about special precautions that must be observed and about the importance of vigilance in connection with: 1. Detection of trespassers; 2. Observance of unusual or suspicious conditions; 3. Actions and approaches of strangers; 4. Suspicious financial obligations; 5. Questions about details of operations; 6. Damage to tools or equipment; 7. Special protective measures applying to their place of work.

Employees should be told the importance of reporting to their immediate superior any person whose actions appear to be subversive. They should report also the finding or observing of any condition or practice that may result in damage to property or injury to employees or others.

Details Are Important

Employees should not try to evaluate the information themselves. But they should be reminded again and again that what appears to be a minor detail may be important enough to report, because it may be a link in a chain of evidence that will help to break a spy ring. Employees should be told not to play detective. Their amateur efforts may spoil a case.

They should be admonished to be patient, even if they think government agencies are doing nothing about the information given them. Employees should be reminded that such agencies keep people under surveillance for months until every contact and movement of the suspected are learned.

Employees should be cautioned: a. Not to spread gossip and rumors, because they injure the innocent and burden the FBI with needless work; b. Not to be unduly suspicious of people with foreign-sounding names. Minority persecution is a breeding ground for fifth columnists.

American Worker's Creed

Every American worker should adopt the following as his creed:

This is my job. Next to my life, my family, and my home it is my most precious possession.
I will protect it against all dangers.
I will observe the actions of others

(Continued on page 78)

Plant Protection Guides Available Without Charge

PLANT ENGINEERING, in cooperation with the Chicago Civil Defense Committee, has prepared copies of the "Plant Protection Guide" for free distribution to all qualified readers. To get your copy drop us a letter or just write "Plant Protection Guide" on the postage-paid card elsewhere in this issue and drop it in the mailbox. We'll send your copy as soon as the request is received. The guide covers detailed information on the following general subjects: Plant control center; Sabotage; Espionage; Employee identification; Proper evaluation and dissemination of information; Aliens; Protection of plant area; Visitors; and Safety measures.

Other books suggested for reading are: "Atomic Attack—A Manual for Survival," published under the auspices of Atomic Implications, Inc., Box 296, University of Southern California, Los Angeles, Calif., price $1.00; "United States Civil Defense," price 25 cents; and "Civil Defense for National Security," price $1.00. The last two books are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

Photo: Humble Oil & Refining Co.

Plant Lubrication Surveys

By T. RICHARD YOUNG, Field Engineer, Foundation for Industrial Research

PLANT ENGINEERING departments have the subject of lubrication occasionally brought to their attention, forcibly or otherwise. Unexpected equipment breakdown with attendant production interruption is perhaps the most unpleasant situation which brings up the subject. At other times pressure from management for cost reduction, from sales representatives seeking to introduce new products, or from the purchasing department wishing to know why a cheaper brand "A" cannot satisfactorily replace brand "B."

About the Author

T. Richard Young has served in many capacities in the field of lubrication. He was research chemical engineer with Beacon Research Laboratories of The Texas Company; he was assistant manager of Lubrication Inc., Rochester, N. Y., contracting for lubrication, engineering and laboratory service. At the present time he is a member of a staff of research workers connected with the University of Wichita.

cause the plant engineer to spend some time thinking about his plant lubrication.

This article is intended as a description of a relatively simple survey procedure which the plant engineer can follow to put his lubrication program in respectable form and to give him a basis for discussing the subject intelligently with vendors and his own management. The provision for a management report on the survey is of value in showing management that substantial economy has been accomplished through the survey.

Before outlining the survey itself, it might be well to put down a few things concerning tests and specifications on oils.

The practice of lubrication engineering is complicated by the fact that the devices to be serviced, machines and apparatus, are mechanical in operation and at the same time the materials used for lubricating the machinery are mineral oils and greases comprising complex physical chemical systems of hydrocarbon oils, soaps, and numerous chemical additives. The behavior of lubricants under various service conditions of load, bearing type, temperature, agitation, unavoidable contamination, and other factors requires a familiarity with physical and colloidal chemistry for even elementary description and control. Thus, lubrication engineering places a demand on the engineer for a combined background in mechanics and chemistry that is not commonly found in plant personnel.

However, it is necessary for the plant engineer to have a basic familiarity with test methods used in specifying oils and greases as indicated later in this article. This background may be obtained from the literature of the American Society of Testing Materials, the American Society of Lubrication Engineers and other sources. However, there is a practical limit to the time that a plant engineer can spend on training himself in this particular part of his job, and he should school himself to seek out those tools of lubrication engineering which he can use effectively, and pass over those more

involved testing procedures primarily used in research work with new lubricants.

The "testing" of lubricants can mean several different things. In the research laboratory the basic characteristics of lubricants, such as the viscosity-temperature relation, oxidation resistance and film strength are studied by whatever laboratory methods seem to yield useful data. The methods vary from laboratory to laboratory and are generally in constant change as the progress of the research necessitates new methods. Eventually the research work builds up enough background to allow the standardization of a given test such as the various engine evaluation tests for diesel and gear lubricants and the numerous oil tests standarized by the American Society for Testing Materials.

A test which "evaluates" a lubricant, such as the hypoid gear lubricant or diesel lubricant test, is usually based on simulated service conditions in operating equipment and is time-consuming and expensive. It is seldom used as a basis for plant buying, but is used generally in lubricant research and in large volume buying as with the Armed Forces and perhaps with original equipment builders.

The simpler tests with which the plant engineer may already have some familiarity, such as the ASTM methods for viscosity, viscosity index, pour point, flash and fire points, steam emulsion number or demulsibility, are usually known as "inspection" tests. Such tests are commonly used for identification of lubricant type and in some cases form the basis for plant purchasing specifications.

Because of their simplicity some inspection tests are frequently used as aids in examining used oils, for diagnosing lubricant trouble, and for determining proper service periods for oils in use. ASTM precipitation number and neutralization number are particularly useful in this last named service. Such use of inspection test data usually requires a background which is only developed after considerable experience with the test data. Certain inspection tests are sometimes used for specifying new oils for use in specific pieces of equipment by the equipment builder.

To return to the main topic, the survey itself undertakes to list the specifications of all lubricants required by the plant equipment, to list the specifications of all currently purchased lubricants, and to select from the latter list a small group of lubricants to handle the bulk of all oil requirements. A few necessary specialized oils will be kept on the purchase list.

An "audit" of present lubricant usage should be made. This summary may be based on purchasing, receiving, or accounting records and should show brands purchased, vendors, total gallons and price for each brand. The price should include tax, freight, package differential charges and other assignable costs to each brand. This data will permit the determination of the total annual first cost of lubricants purchased. The plant engineer should then assemble the manufacturers' bulletins on all the important equipment whose lubrication he is reviewing. Such bulletin material contains the manufacturers' recommendations on lubrication for their equipment.

After the manufacturers' literature has been assembled for study, a tabulation of the oil specifications required for the proper lubrication of the plant equipment should be made from the builders' operating bulletins. Such lubricant requirements usually appear as a specific brand name, as a brand name or equivalent, or as a simple specification. Where a brand "or equivalent" is required, the plant engineer should procure a brand specification from the manufacturer of the lubricant named.

The tabulated oil requirements are then studied to determine a minimum number of oils to handle the great bulk of the whole plant requirement. Perhaps something like the following series of oils may be found desirable:

1—100 SUV* at 100 F spindle oil. High speed grinder spindles, similar light duty, very high speed service.

2—200-250 SUV at 100 F machine lubricant. Electric motors, ring-oiled bearings, light duty and high speed service. Not necessarily highly resistant to oxidation.

3—500-600 SUV at 100 F heavy machine lubricant. Punch presses, similar slow speed, heavy duty service.

4—Oxidation resistant air compressor lubricant, usually containing an oxidation inhibitor, of the viscosity recommended by the builder of the compressor.

5—150-153 SUV at 210 F compounded steam cylinder lubricant containing about 5 per cent acidless tallow as compounding for increased oiliness and better dispersion as a steam cylinder lubricant. Enclosed worm drives, slides, ways, steam pumps and steam cylinders of engines.

6—250 SUV at 100 F, —20 F maximum pour point, naphthene base refrigerating oil. Ammonia compressors, outside winter use for electric motors.

A similar selection among grease types should be made and a family of a few basic kinds selected for covering most of the plant grease requirements. This group of greases will probably include a pressure gun grease; cup grease; a high temperature grease with a soda, lithium or barium base; an adhesive grease for enclosed gears, chains and sprockets; and a heavier adhesive grease for open gearing.

*Saybolt Universal Viscosity

Planned for Coming Issues

Future issues of Plant Engineering will cover lubrication surveys from the standpoint of a field engineer for one of the leading oil companies and an article by an outstanding plant engineer on just what lubrication surveys have accomplished for him in money saved, down-time prevented and general good order and routine. Watch for these features.

In addition to the standard groups of oils and greases above the plant engineer may expect to find a number of special purpose lubricants which have no wide application but must be retained for one or two special applications. Thus, certain pieces of equipment will require lubricants too specialized for use as standard lubricants.

To continue the data compilation, the plant engineer should ask his present oil suppliers for inspection test data on current products purchased. For a typical hydraulic oil used at elevated temperatures the information may include:

1—Saybolt Viscosity at 100 F

2—Viscosity Index

3—Pour Point

4—Demulsibility

5—Carbon Residue

6—A statement of additive content, if any. (Thus the presence of antioxidants, detergents, oiliness agents, pour depressants, etc., should be known to the plant engineer applying the oils. The identification and dosage of such additives need not be stated, merely the presence of particular types.)

7—A statement of the degree of refinement of the oil with respect to oxidation resistance. Generally speaking, oils may divided into those suitable for:

a—Circulating service at elevated temperatures as in steam turbines, diesel and gasoline engines, high temperature hydraulic systems as those having heated press platens

b—One-time or all-loss service at elevated temperatures as in air compressors, steam pumps and engine cylinders

c—Circulating or continuous service at normal temperatures, many unheated hydraulic systems, ring-oiled bearings

d—One-time or all-loss service at normal temperatures, cup-lubricated bearings, hand-oiled bearings

The plant engineer should be able to classify each of his present lubricants into one of the four rough groups above on the basis of their specifications and recommended applications by their manufacturers.

The oxidation of oils and greases varies greatly depending upon temperature, time of exposure, presence of catalysts such as metal surfaces, presence of water, degree of agitation, and the amount of oxygen to which the lubricant is exposed. In addition, a wide variety of oxidation products may be produced, some more harmful than others. Because of these variables no single, satisfactory oxidation test for oil or grease exists which can be universally applied in the present survey of lubricant characteristics. It is for this reason that a simple statement by the lubricant manufacturer regarding the class of oxidation resistance to which any given lubricant belongs must suffice.

It will be found upon inspection of the tabulation of lubricant types required by the manufacturers that many duplications exist. It is the existence of such duplications that permit the reduction of the total number of brands of oil in use.

The next step in the lubrication survey is simply selecting oils and greases from those in current satisfactory use to meet the specification requirements of the standard group of lubricants previously selected for general plant use.

At this point the plant engineer will probably find that he has a surplus of brands, perhaps he will find he is buying pressure gun grease under five different brands for essentially the same service in different departments. The writer recalls one plant found to be using over sixty different brands of lubricants which were reduced to twelve as a result of a lubrication survey.

After setting up the "preferred" or "standard" list of oils and greases, new brands should be accepted as necessary only after a thorough justification of the actual need for a new brand. This is where the plant engineer must exercise good judgment and be capable of withstanding both sales and purchase department pressure. If he cannot stand firm here, he might just as well never have spent time on the survey, as the number of brands in use will rapidly climb back to the normal near-astronomical figure of unmanaged oil buying.

It obviously is advantageous to replace any of the standard lubricants with a superior product as the opportunity arises. A better lubricant choice may be determined from either a quality or cost standpoint. In such replacement it is of course necessary that the plant engineer assure himself that the replacement has adequate properties for the intended applications.

A common over-simplification of lubrication application is found in the advice that "you get what you pay for" in industrial lubricants. This may be true with regard to the cost of producing a lubricant, but if the conditions of application are such that high-cost properties are not used, the oil brand is a poor choice. The writer has seen a firm pay 65 cents a gallon for an oil bought in large quantity to do the same job satisfactorily performed by an 18 cent oil in another firm whose service requirements were considerably more severe.

It cannot be argued universally that the "extra" quality bought in the more expensive brand represents a margin of safety which is good practice. Thus, increased cost in a straight mineral oil is normally associated with increased resistance to oxidation obtained by better refining. However, as the oxidation resistance goes up the film strength and rust protection usually go down.

When additives are used, as in the more expensive oils, oxidation resistance and detergency are usually improved, but tendency for emulsification with contaminants such as condensed water may increase. Further, additives may be removed by highly efficient adsorbent type filters in a circulating system, thus depriving the oil buyer of the added quality for which he paid.

A caution against indiscriminate brand replacement is also in order here. When operating troubles arise and no readily apparent mechanical cause can be found, it is common practice to blame the lubricant in service. Very few such equipment difficulties lie with the lubricant and it is poor practice to introduce a replacement brand in the particular application giving trouble without sure knowledge that the original lubricant was at fault.

For purposes of record a lubrication chart for each major piece of production or operating equipment should be prepared. This chart should show the machine identification, method of lubrication application, period of oiling (oiling frequency), the name of the oiler responsible for lubrication, the machine manufacturers' lubricant recommendation and the standard lubricant actually used as an equivalent lubricant.

Instruction of Oiling Staff

At this point it is very possible for the time-pressed plant engineer to abandon additional work on his reorganization of oiling practices. The system will have little value if it is not put into effective operation. However, if the plant engineer wishes to put his accumulated data and work into practice, some action has to be taken with the actual personnel handling lubricant application to the machine.

Of numerous attempts to insure responsible care in lubrication, the best system known to the author is simply assigning one or more responsible employees to oiling duties who can regard lubrication as an important job. Such personnel should be provided with copies of the lubrication charts previously prepared by the plant engineer. The oiling personnel should familiarize themselves with the information and establish a routine for plant machine lubrication. If the staff for oiling is sufficiently large to warrant appointing a foreman over it considerable responsibility can be centered in his position regarding routine, assignment of responsibilities, and reports on performance of new lubricant brands placed on trial use.

A lubricant chart should be acquired and equipped with suitable containers and dispensing equipment for handling the standard lubricants previously selected for plant-wide use. Any additional specialized lubricants for specific applications can also be included on the cart or truck for the oiler responsible for the specialized equipment. If the oilers honestly believe

(Continued on page 88)

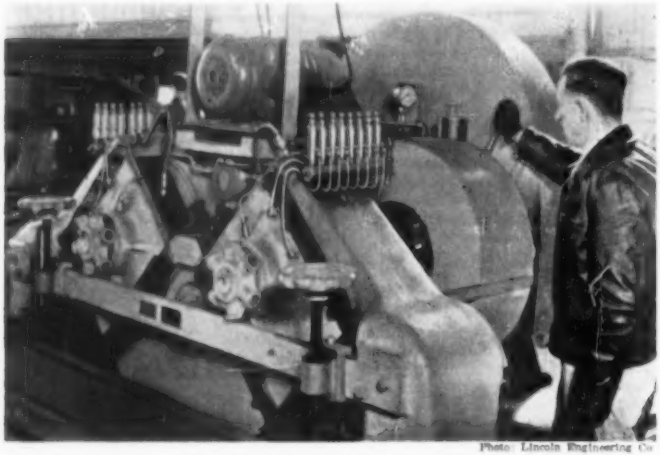


Photo: Lincoln Engineering Co

One of the effects of automatic lubrication on heavy machinery is an increase in safety. Only too often are points of lubrication situated in a hazardous spot

COMMENTS ON:

"We Made It Ourselves"

"We Made It Ourselves"
But Was It Worth It?

Requests for reprints, dozens of letters, resulted from the article in the October issue . . . Some of these are published below, minus names upon request of the authors . . . It is a ticklish diplomatic problem in many plants

Peak Production vs Slack Period

"One thought that may be of interest: On more than one occasion our company has pioneered new processes requiring machines of a special nature. The machines probably could have been purchased on specification from a builder more reasonably than we produced them. However, we did not know the ultimate outcome, therefore we were able to make the needed alterations to suit the desired end. Experience has taught us what the economical organization should be and the equipment necessary to maintain a steel plant of our size. During periods of peak production we purchase all of our new equipment and some of our maintenance repair items. In slack periods, in order to hold our organization intact and to utilize our equipment, we build most anything within our ability, consistent with quality work."

Top Man Top Offender?

"The article in your October issue on "We Made It Ourselves," is excellent. The only exception I can take is that in my experience the chief offender is usually someone in top management. This is generally someone who has little or no engineering experience but who thinks it possible to add 2 and 2 and get 5, or who would like to beat the maker of standard equipment at his own game.

"Plants which are operated by men with broad experience or by engineers realize that a machine tool builder has gone through growing pains before he puts a machine into production and on the market. It is hard for any plant, not in that particular line, to duplicate the combination of performance, materials and prices when making only one or two machines of the same kind for their own use.

"I agree that there are times when it is necessary to build a machine, the like of which can not be found on the market. But, after many years of experience, I know these times are few and far between. The writer suggests that the original article be reprinted in management magazines where top executives can read it.

Much like the author of the original article, I do not want my name to appear. My present employer is the kind who is prone to take an obsolete machine and try to make a new piece of equipment out of it—without success, to date."

Comes a Time, However—

"Recently we purchased a machine costing over $4,000. It was designed to do a special grinding job. The production achieved reached 900 pieces in 8 hours. We replaced it with a machine made in our own plant at a cost of less than $1,000 which is now producing 2300 to 2400 pieces per 8 hours. This is a rare case and only possible if a job is very special or peculiar to your product. Purchased equipment usually is superior."

—When It Must Be Done

"In a specialized line such as ours, we frequently build or have built for us, equipment other than standard for piloting new operations or to save valuable time in obtaining the equipment required. We buy and group standard equipment even to the extent of modifying some items to suit our needs. It usually costs more to build it yourself if all the cost is accounted for."

Determining Real Cost

"I think the author missed an important point in determining real cost. 'Out of Pocket' expense to the company should be the determining factor unless the item is so technical in nature that local 'know-how' is missing. By 'Out of Pocket' expense we mean the sum of direct labor, material and supplies, such as files, drills, etc., directly applicable to building the gadget. This cost should not include overhead usually allocated to every productive hour in the plant, which includes taxes, rent, administrative and supervisory expense, all of which go on regardless of whether we build or buy. When these fixed expenses are recovered by a loading rate applied to every direct hour in the plant, or when we reduce the direct hours we reduce the recovery for the fixed expenses and may run a deficit over the year.

"If an accounting system loads these fixed charges against purchased material, then the bids of the outside manufacturer do not look so attractive. For this reason a decision whether to build or buy should be determined on the real economies of the case, not on the apparent ones as indicated by the author. For instance, we have to replace a roof. Outside bids are then received for $50,000.

Our own labor, material and supplies are estimated at $40,000. When loadings are added this comes to $60,000 or apparently $10,000 more than an outside contractor. However, the 'Out of Pocket' cost to the company is $10,000 less than the contractor bid and we would decide to do the work ourselves, since the taxes, depreciation, administrative and similar expenses go on just the same in either case."

LOAD? LOCATION? LEAKS?

Factors Affecting Efficiency of Compressed Air Systems

THE ECONOMIC BENEFITS to be derived from the use of air-operated tools, devices and equipment in manufacturing may be weighed more accurately when considered in relation to the cost of the entire compressed air system, including the applications for this power. Much has been said concerning the increased productivity which is frequently possible by the use of pneumatic tools and devices. While there is much to be said on the subject of increased productivity with pneumatic tools, this article will deal primarily with installation of the air compressor plant and the distribution system as related to over-all costs.

The plant engineer who is planning a new factory, or an addition, or enlargement and modernization of his present compresed air system has the problem of determining what the air compressor capacity should be. This means making an accurate estimate of the amount of compresed air consumed by each piece of air-operated equipment and also having a pattern of probable peak and valley demands upon the compressor plant.

Actual tests may be made to determine the amount of compressed air used per minute by any equipment, or the information may be obtained from the manufacturer of the tool or equipment. The data is similarly available in handbooks. These figures, whatever their source, are only a starting point. Only the manufacturer can determine how much time various air-operated equipment is in use for the average working day. It is not an uncommon mistake to take the air consumption of a tool per minute and figure out the total on a full day's use, but rarely is a pneumatic tool or any other air-operated device in continuous use. Also, tools in the tool room are sometimes included in these estimates when obviously they are not consuming any compressed air at all. This kind of overestimating can result in a capital investment larger than necessary.

Figuring the total amount of compressed air needed should not stop with the accurate estimate of air required by tools and equipment now in use. In varying degrees, most factories will find manual operations which could be better done with the aid of compressed air applications. This subject of selecting the right tool for the job is worthy of a series of articles in itself and no abbreviated discussion will be attempted here. Suffice to say, there are ways of making such an analysis and one should be made before determining the plant capacity needed.

What Plant?

With the total figures before him on the estimated amount of compressed air which will be needed in daily operations, including peak demands, the plant engineer is ready to consider the compressor plant which will best meet his requirements. Standard units are made in a wide variety of types, sizes and characteristics to meet an equally wide variety of service conditions. Decided operating economies, in the compressor plant and at the point of work, may frequently be gained by making the correct choice. Compressor manufacturers' literature, their representatives and data such as may be obtained from Compressed Air Handbook, all cover compressors in the detail which is necessary for an intelligent consideration of the subject.

A machine of any kind must be overhauled at intervals and occasionally repaired. Air compressors are no exception and this fact should be kept in mind when determining how the indicated air capacity is to be provided. For example, rather than providing the capacity needed with one single unit, it may be better to have two or more smaller units so that a continuous supply of air will be assured regardless of any one unit being down. Frequently, new compressors are added to an old plant. In such a case, the old units are usually serviceable for standby duty. That fact, however, does not always preclude further consideration of adding to or replacing compressor capacity with more than one unit. If there are many hours when the demand for compressed air is relatively low, one large and one small unit might be installed so the large unit would not have to run during low demand periods. Various other compressor unit combinations can be adapted according to the actual conditions.

Where practicable, compressors should be in a central plant. This gives unified operation and care, better supervision, usually less labor cost and, since compressors in a central plant are likely to be operating no more than necessary to maintain pressure, load factor and operating efficiency are relatively high.

In the event excessive piping cost outweighs the advantage of a central plant location, it is desirable to divide the compressor plant into two or more installations at, or near, specific load centers. This reduces piping cost and provides higher pressure at the load center. When compressors are separated, plant piping should be interconnected so air may be distributed either way to meet peak load requirements.

Air compressors should be located in dust-free rooms, especially so in foundries, woodworking plants and other dusty industries, and provision should be made for drawing clean air from the outside to the compressor intake, preferably through an air filter. Compressor foundations built according to good engineering practice for this type of machinery is another important consideration in the installation of a good air compressor system.

A well installed air compressor plant of the type suitable for the work to be performed and of adequate capacity is one of the most important steps in assuring efficient and economical operation at the points of use, but the plant alone is not the whole story. Many a manufacturer who may be considering adding capacity to his compressor plant may find his plant is entirely adequate, but that the trouble lies in his distribution system. Undersized piping, or air leaks, or both may be the cause for trouble rather than inadequate compressor capac-

All of these factors, and many more too, must be considered when planning a new air compressor plant or when enlarging your present installation . . . Testing tools for air requirements . . . Advantage of stand-by units . . . Make the piping large enough; small piping is a doubtful economy . . . Check for leaks and avoid cheap air hose . . . Use nipples sparingly and hose menders not at all . . . Initial need?

By **EDMOND C. POWERS**, Educational Director
Compressed Air & Gas Institute

ity. That can result in the lowering of the productivity of the high-hourly-rate worker using the pneumatic tool or other device and also the loss of power.

The principal cost in installing a main distribution line is labor rather than material, so there is little economy in using small sized piping and and it can be very expensive to do so. For example, take a 3-in. air line, 1000 ft long. It will handle 500 cu ft per minute with a 2.5 lb pressure loss. If a slightly more expensive 4-in. line were installed, it would handle twice the volume of air of the 3-in. line before the pressure loss of 2.5 lb were equalled. Adequate sized air lines are good economy on the original installation and also provide a margin for expanding the compressor plant without having to install new distribution lines.

The manufacturer who is not getting desired air pressure at point of use would do well to check his lines for size and then look for leaks, because leaks are expensive. The best managed plants are likely to admit that not much has been done recently in the way of keeping an air-tight system. The fact that escaping air is neither hazardous nor obnoxious may be one of the reasons for this common oversight, but the fact remains escaping power of any kind is expensive. One 1/16-in. leak in the air system will cost around $10.94 a month. A $\frac{3}{8}$-in. opening, not altogether uncommon, will cost as much as $400 a month. It doesn't take many leaks to make air power losses mount up. There are no excuses for such losses, especially in view of the ease and low cost of maintaining an air-tight system.

The above costs are based on air at 6 cents per 1000 cu ft at 100 psi.

There are other important considerations in connection with distributing compressed air to the point of use. Air hose can severely restrict air pressure delivered to the tool and, to avoid this condition, should be as large as practicable and as short as practicable. Inferior hose has a tendency to disintegrate on the inside and restrict the true size of the interior diameter. Nipples are necessarily inserted into the end of the hose but provide restriction. Hose menders are bad practice, because usually $\frac{1}{4}$-in. pipe used in $\frac{1}{2}$-in. hose, which restricts the hose. The reason for inadequate air pressure at the tool is found more often in the hose between the valve and the tool than at any other point in the system. An air gage with an adapter and hypodermic needle inserted in the hose at the point of work, while the tool is running, is the easiest and most positive way to detect pressure restrictions.

Dry air as well as air at adequate pressure is an important consideration in the distribution system. The tools and equipment require less maintenance and have a longer life as a result. Most air lines are sloped slightly so that any moisture will flow back into a trap or leg. Lines

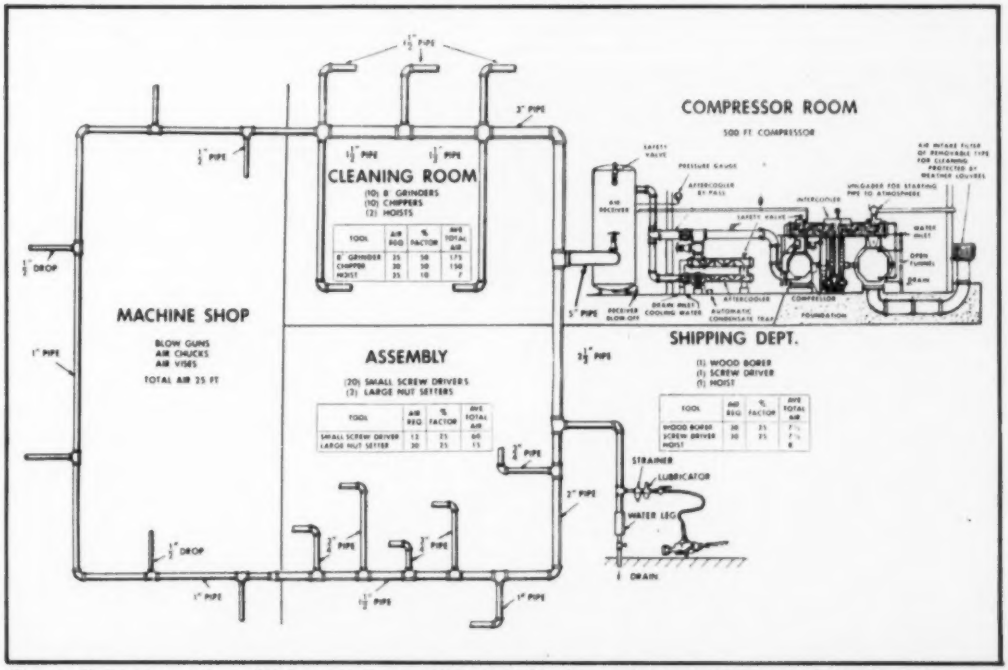


Fig. 1. Typical layout for a 500-ft compressor installation. A drawing or sketch of this type will help determine needs

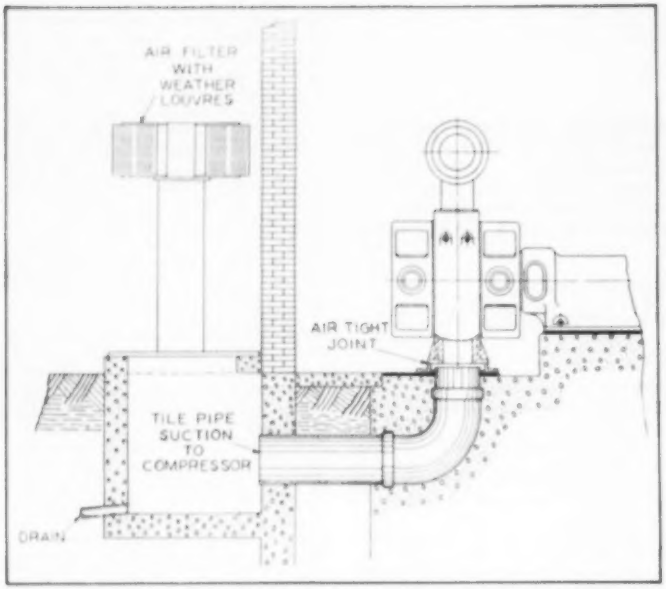


Fig. 2. Details of filter attached to intake pipe of compressor to eliminate dust or other foreign matter from interior and prevent rapid wear of moving parts

leading off the main distribution system should be connected at the top of the pipe, instead of the bottom, so moisture will be avoided. Aftercoolers at the compressors eliminate moisture which might otherwise enter the system. They should always be used where dry air is required.

Estimate of compressor capacity needed, selection of the right type and number of units, location of the plant and a well planned distribution system are all important factors affecting the cost of producing and using compressed air. Once the proper provisions have been made for the system which will best serve the individual plant, the factors making up the cost of producing compressed air may well be considered. These factors are: operating cost, including power, labor, lubricating, etc.; depreciation; and interest on investment.

Selection of Drive

Air compressors may be driven by electric motors, steam, oil engine or gasoline engine and the selection of the compressor and operating conditions depend upon the power to be used. The variation of power costs and availability will determine this selection in any particular area. In order to get an example for calculating production cost, a standard small-size duplex, two-stage synchronous motor driven compressor might be analyzed.

The initial investment will include the equipment and installation. The equipment, in addition to the compressor itself, would include motor, exciter (if needed), starter, aftercooler, receiver and foundation bolts. The installation would include foundation, rigging and erecting, piping and wiring. For operating time, assume it is 22 days per month, 10 hr a day.

Fixed Charges

Fixed charges will include depreciation, insurance, and repairs which are entirely separate from normal attendance or supervision required. Taxes are negligible for the installation given as an example, but might be included on very large installations.

Lubrication for the unit cited would require about 0.06 gallons per thousand horsepower hours, at approximately 65 cents a gallon. Two hours attendance a day, say at $1.25 an hour, would be required. Cooling water is estimated at full load, say at 10 cents per 1000 gallons.

For load factor, assume the compressor will be operating half the time at full load and half the time at half load, which makes maximum demand $^3/_4$ load and a load factor of 75 per cent.

Ratio compressor load to total plant load for electric power used will give the power cost according to the local rate. For the sake of the compressor example cited, figures following will be based on $^1/_8$ of the total plant load for the compressor at rates of a large public utility which is close to the average, with the first 1000 kw-hr at 3 cents and reducing to 0.6 cents in six steps to the next 100,000 kw hours.

With this background to calculating for production cost, we have: An air compressor driven by a 125-hp motor for 220 hr a month, it cost $8,932 for the initial investment, plus $1118 to install for a total of $10,050:

Monthly charges are $50.25 for fixed charges and repairs; $107 for lubrication; $55 for attendance and $30.50 for cooling water, for a total of $136.82:

Producing 6,525 thousands of cu ft per month when operating at 75 per cent load factor with electric energy costing $149 a month (which is $^1/_8$ of the example company's $1190 monthly cost for electric power):

Giving a total monthly cost for compressed air of $385, or $0.059 per 1000 cu ft.

Grounding Portable Tools For Safety

Contributed by Westinghouse Electric Corp.

WHEN USED carelessly and without a few basic precautions, the portable electric tools commonly found in industrial plants can offer a serious threat to safety because of the possible danger of low voltage electric shock.

However, this potentially dangerous situation can be corrected if this 3-point program is followed: 1. Proper grounding equipment; 2. Scheduled inspection and maintenance; 3. Constant education.

Proper grounding—Instead of the conventional two wire system of cable and receptacle, all outlets and cables should be of the three wire type; the third wire being the ground wire. Each receptacle box is fitted with a receptacle into which a three point polarized plug can be inserted. The third point is attached to a ground wire which is a part of a standard rubber covered cable. Converting a plant to this system may be a considerable undertaking but the results in increased safety will far out-weigh the added expense. It would then be unnecessary to depend on each workman attaching a ground wire each time he had occasion to use a portable tool.

Inspection and maintenance—A card record should be kept on each portable tool. This record should show tool number, description, date issued, to whom issued, and history of repairs. The tool room arranges, from this record, to call in each tool once each calendar month for inspection and insulation test.

Educational methods—Through supervisors, group leaders and safety observers a continuing educational program is carried out. A fair share of attention is given to low voltage electric shock and the hazards which might produce shock. Proper use of portable tools is stressed. In addition, selected employes are periodically trained and rechecked in artificial respiration techinque so that they may be prepared to render first aid in the event of electric shock.

Mighty Muscled Midget

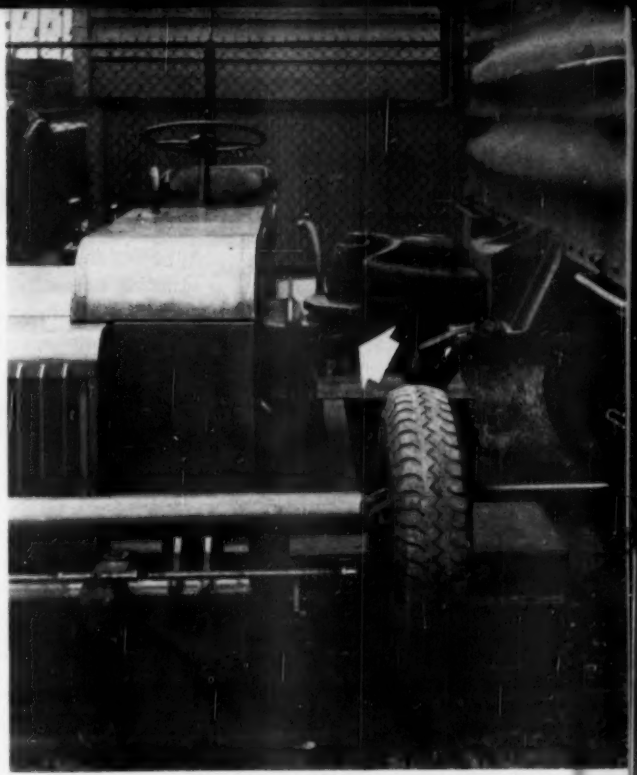
LOW COST HAULING, spotting and switching of railway cars is within the reach of every industrial plant with the unveiling of a revolutionary new piece of motive power equipment. The small gasoline-powered Trackmobile makes ingenious use of hydraulic jack power for two of its greatest features: First, ability to travel either on the railway track or on the ground and to change from one to the other in just 30 seconds. Second, the same power is uniquely employed to develop a pulling power greater than that of heavier locomotives.

Versatility of the unit is increased by the possibility of using it as a standard industrial truck or tractor for hauling industrial trailers. The manufacturer points out that its use in this manner has the following drawbacks: Due to its construction without a differential the turning radius is 20 ft. Thus undue wear on the tires will result when pulling heavy loads on the ground. Attachments most likely will be available, however, to make such service possible.

Cost of the Trackmobile is considerably less than that of any other type locomotive of comparable draw bar pull. Its speed on road wheels is conservatively listed at 20 mph, maximum; on track wheels the speed is variable with the load. On track wheels it can pass through any door that will pass a railway car. On road wheels it will clear anything that will pass a motor truck.

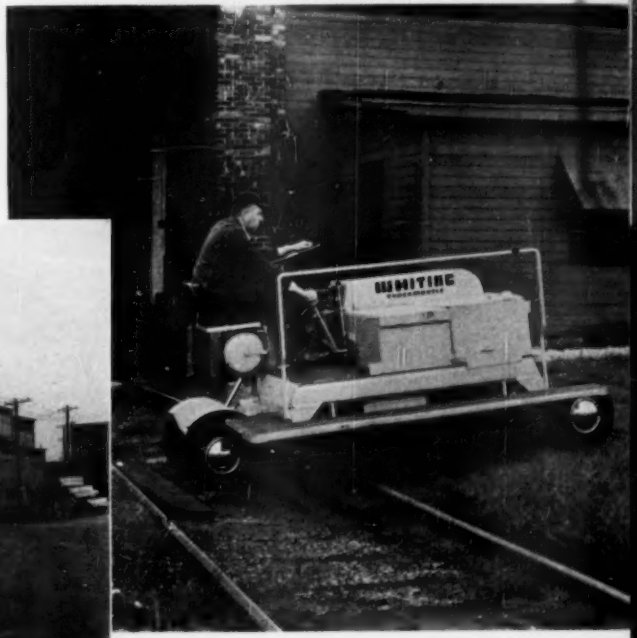
Some of the uses recommended for the unit are: Moving cars across track scales; spotting cars at loading docks or in plants; shifting cars onto transfer tables; moving Diesel locomotive or similar trucks about the shop.

If you want additional information on this new piece of motive equipment just write "Trackmobile" on the no-postage-required card, pages 19 or 85, and mail it.



One secret of the Trackmobile's efficiency is the operation of the coupling (arrow, above). When coupled to a railway car it uses a self-contained hydraulic jack to raise the coupling, shifting part of the car's weight to the Trackmobile, increasing adhesive force

Below: Of advantage in nearly every industrial plant is the unit's ability to cross tracks in the yard without regard to regular traffic crossings. This speeds up its transfer from one point to another



Below: Although the new unit has plenty of power for pulling fully-loaded box cars, it weighs only 6000 lb. The driver's seat is so placed that it affords full vision of the track in either direction on his side of the car

GROUTING PRACTICE

Adjusting frames, sole plates and bases with shims, plates, wedges and adjusting screws . . . Alignments of shafts and flexible couplings and gears . . . Misalignment due to varying night and day temperatures . . . Grout mixtures and additives . . . Jacks and wedges for leveling

By **LEON A. WATTS,**
Manager, Service and Erection Dept., Allis-Chalmers Mfg. Co.

PREPARATION OF BASES and mixtures for grouting vary somewhat with the machines to be grouted. The steps and techniques involved are vital to establishing good foundations. These particular recommendations may not apply to all equipment, but they may be useful to erecting engineers since all grouting requirements are based on the need of creating a temporary plastic or fluid connection (grout which eventually solidifies) between the precast base foundation and the equipment to be erected on the foundation. Although we are primarily concerned with the use of cement, sand, rock and water, grout made with molten sulphur or zinc, lead, iron, and steel turnings mixed with a solution of salammoniac has been applied successfully in unusual installations.

One of the prime requisites, as stated in Part I, in preparing equipment for grouting is to remove all of the oil, paint and mill scale from surfaces which will be in direct contact with grout. This should be done while such areas are exposed and accessible. Cleaning is usually done before the machine is landed on the foundation bolts.

The next step involves adjusting of frames, sole plates and bases with plates, shims, wedges, and adjusting screws. To facilitate grading, aligning and leveling of sole plates and bases, it is best to drill and tap them for suitable jack bolts, or adjusting screws, if the latter are required. These jack bolts are generally placed so as to adjust heavier parts with an occasional jack bolt in areas of the base not subjected to concentrated loads. Considerable time and money could be saved if all equipment was provided with suitable jack bolts wherever they are feasible.

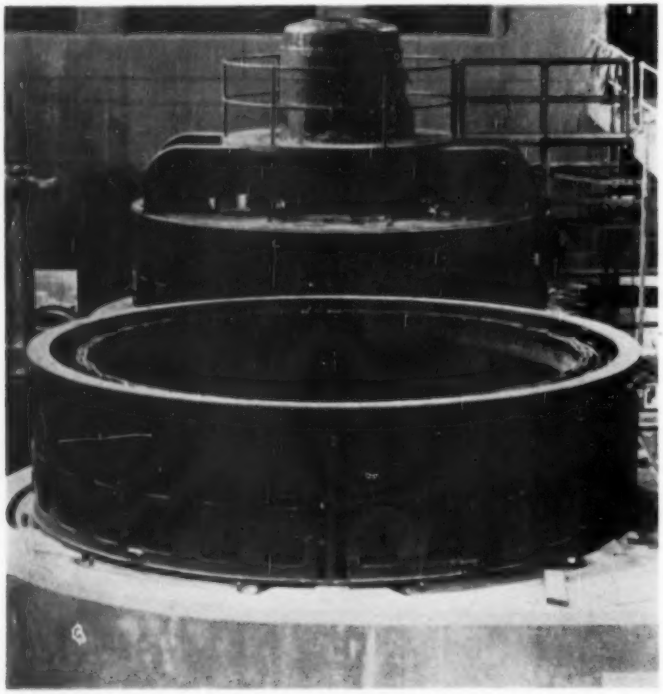


Fig. 1. This large hydro generator has been aligned, leveled and graded and is secured on nests of shims which are properly spaced. Space between generator base and foundation, approximately 2½ in., will be ready for grouting when grouting forms are installed. After grout sets, leveling wedges must be removed

Before equipment is placed on foundation, drawings should be consulted to determine where heavy or concentrated loads will be placed. This particular foundation area should be relatively level and smooth. A steel plate of suitable square inch area, say 4 in. by 10 in. and as thick as praticality permits, should be embedded in a batch of three parts of sand and one part cement mortar with very low water content. Plates should be leveled both ways roughly and allowed to set. To prevent base or plate from distorting when nuts are tightened, similar plates should also be placed adjacent to all foundation bolts. After these steps have been completed the machine should then be placed on the foundation and shored to proper grade with the aid of plates, shims, jack bolts, or wedges.

Frequently, grades or elevations are obtained from bench marks adjacent to the equipment and transferred by a surveyor's level or transit. In self-contained equipment, this may not be too important. Sometimes, the grade is determined by a previously established location of a companion coupling or penstock.

When coupling or gears are involved, the leveling of horizontal machines becomes quite complicated. Frequently, adjacent shafts must be located slightly out of level upwardly to obtain proper vertical coupling or gear face alignment.

All horizontal shafts deflect to some degree and if all bearings are

[1] This is the second of two parts. Part I appeared on page 67, September, PLANT ENGINEERING.

set dead level the deflections cause the coupling faces to be out of vertical or plumb. A pair of two bearing elements such as a motor and a steel mill roll, or a hydraulic turbine and a pulp grinder frequently may have their rear bearings slightly elevated above center line to bring coupling faces parallel and vertical. Multiple bearings and long elements such as line shafting or a string of units, cannot be corrected readily. The couplings are pulled together to give the effect of a continuous shaft. This same practice can also be applied to two bearing elements, but this depends on coupling flexibility and relative shaft stiffness.

Flexible couplings or gears can be aligned by either of the two previously mentioned methods, or by a specifically planned compromise. It should be remembered that flexible couplings will not compensate for misalignment in either the vertical or horizontal plane. A flexible coupling must be aligned as accurately as one that is solid, if satisfactory results are expected.

Proper foundation and alignment can be obtained only when nests of shims are stacked, and wedges and jack bolts set so as to provide a tight contact with the base or sole plate. They should be set in a manner which will enable wedges, adjusting bolts, or jack screws to be removed easily after grout has been poured, tamped and set. If these adjusting devices were not removed they would establish a small area or point of concentrated load contact which would in time be eliminated by vibration and brinelling action, causing foundation bolts to loosen or possibly result in misalignment of equipment. When the metal contact areas of the wedges or jack screws are removed by vibration, the load settles loosely on the foundation area.

Temperature Affects Grouting

Good grouting demands serious consideration of both direct and indirect characteristics and influences. One of the vital indirect factors is the effect of temperature on foundations of equipment placed on horizontal foundations. Such machines are usually at ambient temperature and in equilibrium. However, allowances must be made whenever a basic temperature difference such as 50 deg basic ground temperature prevails in contrast with a cold or hot air temperature around the machine.

Another set of problems confronts erecting engineers working with foundations which are not cast integrally and one end of which is subject to ambient or room temperature and the other to a high temperature. Steam turbine or engine foundations are typical examples. Because the coefficient of expansion of concrete and steel is, for all practical purposes, the same, induced heat in the steam ends of such foundations intensifies and adds to difficulties.

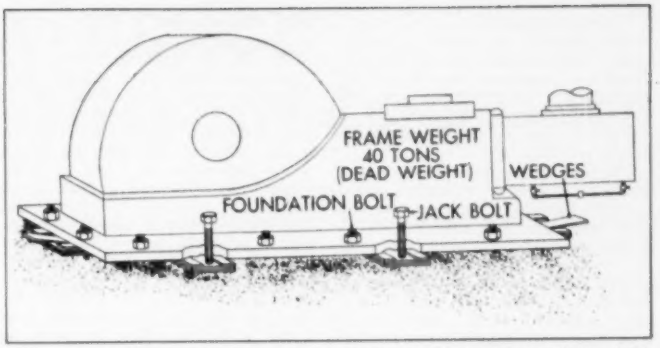


Fig. 2. Loading on the foundation due to tightening the twelve foundation bolts equals approximately 20 t. Total load, including weight of engine, is about 60 t

When aligning and grouting heavy machinery, it should be remembered that the rate of heat absorption from conduction and radiation is poles apart where one portion is subject to room temperature and the other to a considerably higher temperature. To disregard these differences in temperature under such conditions usually reduces operating performance of equipment after grouting. This is especially true of equipment mounted on sectionalized foundations. Turbo-generators having several separate foundations, or cement kilns having from two to six different and distinct foundations with the extreme temperature differential between the feed end foundation and that of the firing or discharge end are of this type.

Serious misalignment due to night and day temperatures have been experienced in long penstocks and heavy hydraulic equipment subject to solar heat. In some instances, expansions due to unequal temperatures had to be equalized by water spraying before and during grouting to assure permanent alignment. There is a definite relationship between grouting, temperature differential and alignment which, if disregarded, can cause considerable operating difficulties and financial losses. However, the complications can be eliminated, or at least minimized, by stressing proper preparation of grout and adhering to practical methods of grouting to meet varying, but specific needs.

Grout Requirements Vary

Generally, grout ingredients are mixed dry and until the mass is homogeneous in color. Water is then added and the grout is mixed for at least 30 minutes in a mixer or 50 minutes with a hoe before it is poured or placed. Either hand or mechanical mixing may be used, depending upon the quantity required per batch.

For standard grouting, use a mixture of one part cement, two and one-half parts of clean sharp or three parts of well rounded river sand with sufficient water (determined by local conditions) to obtain proper grout flowability. This mixture is satisfactory for a grout space up to 2½ in. Three and one-half to four parts of ½ in. gravel should be added to mortar mix for grout spaces in excess of 1.5 in. For spaces over 6 in., gravel may be replaced with 1 in. river stone or 1 in. crushed stone. Water content is determined by actual requirement.

Cause of Shrinkage

It should be remembered that shrinkage of grout or concrete is chargeable to the loss of water bled from grout after it is placed. Water should be kept as low as possible under all conditions but should not be so low as to impair flowability. It is also possible to reduce shrinkage by reworking the grout about 30 to 40 min. after the grout has been thoroughly mixed and allowed to set for 30 min. Reworking is possible in only a few cases, and should not, under any circumstances, be attempted when grout contains ingredients used to combat shrinkage.

There seems to be considerable misconception or misunderstanding regarding the use and application of certain ingredients for the supposed purpose of overcoming shrinkage and expanding the grout to produce pressure contacts on sole plates and bases of machine equipment. True, the application of gas or air bubbles under certain conditions will inflate the grout. However, this is similar to and as effective as putting yeast in dough. The gas or air bubbles may cause the grout to puff up and contact the sole plate, but will not create any up-lifting pressure against the base. In other words, air or gas bubbles will not cause the grout to take any load while the load is being held and carried by the wedges and jack-bolts. For best results, the grout area should be loaded up by tightening all foundation bolts equally after the wedges have been removed and the jack-bolts slacked off so they do not carry any load.

Grouting problems are never affected directly by weather conditions involving sub-freezing changes. There are instances where air or gas bubbles are beneficial to concrete structures, or even where the porosity due to gas or air is helpful in sound-proofing.

There are other ingredients which may be used to expand grout through oxidation, corrosion or just plain rust. However, since in this instance the jack bolts and shims will be removed thus eliminating the slight shrinkage by tightening all foundation bolts and placing the weight directly on the grout which will offer considerably more contact area than the point contacts established on the wedges and jack bolts. If and when it is found that iron or steel particles will develop a denser mass by expanding, and therefore, a grout which will withstand heavier unit loading, it seems reasonable to consider favorably the use of such ingredients.

Objectionable shrinkage will not occur in grout areas that are 2½ in. high or less and in which water content has been properly controlled and held to a minimum. The actual contact area under a sole plate or pedestal is comparable to a flat thrust bearing or a cylindrical or bushing type bearing, i.e., around 75 per cent contact of the pedestal or sole plate on the grout. These contact areas should be numerous and strategically distributed.

For heavy, concentrated loading, a mix of one part cement, 3 parts clean round sand is adeqaute for vertical grout space up to and including 2½ in. Requirements for anything over 2½ in. should have a mix of one part cement, 3 parts graduated clean screened uniform round sand and 3 parts of ⅜ to ¾ in. river gravel, or its equivalent of crushed stone. A good concrete foundation may be obtained by mixing one part cement, 3 parts clean sharp sand and four parts of 1½-in. washed stone, or screened 1½-in. river pebbles.

In nearly all cases there is a tendency to use too much water, and since the water content is vital, it should be given special attention when mixing either grout or concrete. A simple test to determine whether concrete contains too much water consists of taking an ordinary galvanized pail filled with concrete mix and turning it upside down and removing the pail. If the settling exceeds two inches there is too much water in the concrete.

Although engineers agree that jacks and wedges are necessary for grouting, many of them believe that these devices should not be removed. Experience proves definitely to the contrary.

Heavy equipment needs many square feet of grout to support its weight and withstand the rigors of operation. A few points of contact with concentrated loading of 10 t per quarter square inch or 40 t per sq in. are not practical. See Fig. 2.

Assume that a large rotating machine requiring a grouting area of 5 by 10 ft is to be placed on a pre-cast foundation measuring 6 by 12 ft. In addition, the machine frame will weigh about 40 t and is to be aligned, leveled and graded 3 in. above the pre-cast concrete base. The frame is also provided with ten bosses properly located to receive ten 2-in. foundation bolts. An adequate number of iron plates, approximately ½ in., ¾ in., and 1 in. thick should be placed under the frame at six locations in order to align, level and grade the frame. Grading and leveling with wedges and jack bolts can be started after the nests of shims have been properly spaced and located and embedded in motor previously pointed out.

Also assume that the 40 t is equally distributed on six wedges or jack bolts, each having about ¼ sq in. bearing surface area. The grout is not yet ready to be placed in the 3 in. space between the base of the engine and the rough and wetted top of the foundation.

In the first place, the machine frame may shift out of level or grade from external vibration if it is not secured to the foundation by tightening the nuts on all foundation bolts as equally as possible so that each is strained to a load of approximately 2 t. A check of the grade and level shows that the machine is a fraction out of level, but does not seem serious enough for releveling. Further checking reveals that tightening of the foundation bolts has added approximately 20 t to the loading on the six ¼ sq in. area contacts on the jack bolts and wedges, so that the concentrated load on each of the six points of contact is now in the order of 10 t per quarter square inch, or at a rate of approximately 40 t to the square inch.

Everything is in readiness for grouting. Grout mixture, labor and all other requirements are ideal. Mixture contains about 6 gal of water per sack of cement and is adequately spaded and agitated to provide an excellent, sound and high compression strength grout. Assuming that a week has passed since preparations were completed, the installation is still not ready for the live load simply because the frame is still loaded on the knife edge and point contact of the wedges and jack bolts. Gravity grouting, in contrast with pressure grouting, will not and cannot develop any upward pressure against the machine frame. Under these conditions 75 per cent contact at zero pressure is considered normal. Then too some shrinkage has occurred.

The equipment will operate satisfactorily if it is left on its wedge and jack bolt foundation, but it will operate only until it peens or Brinnells the six 10-t contact points be-

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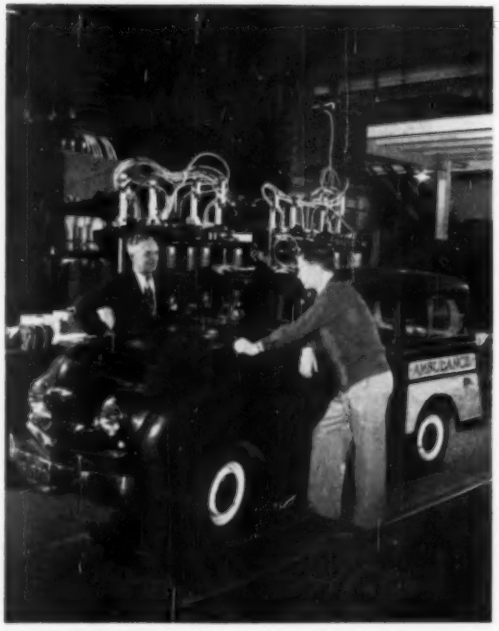
Indoor Ambulance at Westinghouse Sharon Works

This indoor ambulance can speed down any manufacturing aisle inside the Transformer Division Plant of the Westinghouse Electric Corp. at Sharon Pa. It's the latest innovation in the safety program of this plant which has already won National Safety Council citations four consecutive years for being one of the safest plants in the heavy machinery industry. On call 24 hours a day, the specially-designed Crosley ambulance can reach any part of the three-fourths of a mile long plant within several minutes and can proceed directly to a hospital if necessary. It can accommodate a full-length stretcher with ease



THE SNOW FENCE
Its Industrial Use and Application

Snow fences vs tree breaks and hedges . . . Types of fences . . . Location . . . Height and installation . . . Use in very deep snow . . . Use on ice surfaces . . . Maintenance and storage of various types . . . Experience of highway departments . . . Purchase specifications . . . Probable life

SNOW FENCES, while generally associated with railroads and public highways, have a definite and utilitarian industrial application. This is particularly true in many of the newer plants built in rural and urban areas.

With wide open spaces, extensive walkways, driveways, parking lots and working areas to be kept clear, the snow removal problem is expensive and in many areas serious from the standpoint of interruption to production.

Unfortunately, snowstorms cannot be stopped. The removal problem can be minimized, however, by changing the location of nature's drift areas and controlling drifting so that areas once cleared, stay clear. Furthermore the wind itself can often be utilized to keep open areas clear.

A snow fence properly installed can do this and is the quickest means of bringing drifting snow under control. The tree break or hedge can be made to serve the same purpose. It is not as flexible, however, and cannot always be used because of landscaping considerations. Beauty and utility do not always go hand in hand.

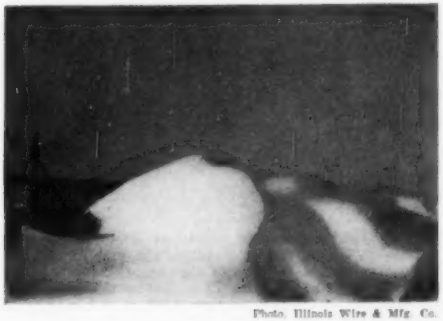
Primarily the snow fence is not a barrier. It is a device to break up the wind so as to cause eddies and promote drifts. A drift well packed by the wind will gradually acquire a hardened condition which will remain in place until melted in the spring.

Judiciously placed the snow fence will also reduce the removal load in natural drift areas by shifting the drift area from the roadway to open spaces. It is used extensively by State Highway Departments which use millions of feet of fence each year.

In general the fence should be placed about 100 ft back from the road, always on the windward side in case of a prevailing wind and always on the high side. Geographical considerations are extremely important in the placing of snow fences. It should never be set down in a hollow. If there is a hill or ridge to utilize it is best to put the fence back, even as far as 300 to 400 ft, in order to take advantage of the terrain.

The most commonly used fence is 4 ft in height although shorter and longer fences are made for unusual conditions. The 2 ft snow irrigation fence is useful to hold snow on higher ground or to keep and control drifting in large industrial areas. It is used extensively to hold snow on golf courses.

Occasionally, for landscaping purposes on estates and small industrial areas an old-fashioned board or rustic fence with wood posts is still used. If this is considered advisable the log should be stripped of bark, otherwise the life expectancy will be short.



Photo, Illinois Wire & Mfg. Co.

Fig. 1. A combination wood and wire snow fence properly installed. Note the drift nearly twice the height of the fence itself. The standard fence is four feet in height, weighs about 3 lb per linear foot and is commonly supplied in 50 and 100 ft rolls

Photo, Northfield Iron Co.

Fig. 2. A well installed steel snow fence in Minnesota. With the proper slant and prevailing winds the ground next to the fence is kept clear. Steel fence costs about twice that of wood picket fence, weighs slightly less, and has double or triple the life expectancy

Commercially, two types of snow fences are in common use. The picket and wire fence as shown by Figs. 1 and 6 and the steel fence as shown by Figs. 2 and 4. Either type can be used continuously or in short lengths, depending upon local conditions.

The wood fence goes under several names, such as "combination wood and wire," "picket and wire" and "wire cable lathe." This type is made in 3, 3½, 4, 5 and 6 ft heights and is supplied in rolls of 50 or 100 ft. The 4 ft fence is considered the general utility fence for drift control. It costs from 21 to 23 ct per lineal foot, the price variation being due to color, wood and picket size. It is usually woven with five strands of 12½ galvanized wire and weighs about 3 lb per lineal foot.

While pointed pickets are available, the square type is preferred because it can be reversed from year to year to prolong the life. Picket sizes range from ½ by 1½ in. spaced 2 in. apart to 2 by 7/16 in. spaced 2½ in. apart. Red is the color most commonly used although green can be purchased and at least one company will supply fence treated with wood preservative in natural black.

The Pennsylvania Highway Department buys some two million ft of fence a year and has developed

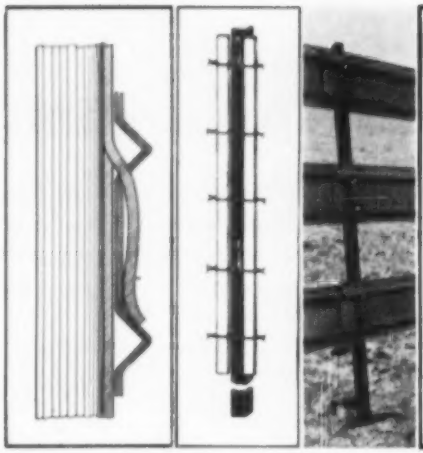


Fig. 3. Steel posts are used with both types of fence. Typical details show how the fence is hung on hooks stamped in the wide leg of the angle iron posts. Standard 6 ft posts have two hooks, 8 ft posts three, and weigh 1.44 lb per ft

Fig. 5. If set at an angle of 5 to 7 deg. a steel board fence can pile snow twice the height of the fence. Too little slant is better than too much

rigid specifications.* A wide choice of wood is permissible. These listed in the order of preference are: ash; beach; cedar; chestnut; wild cherry; Douglas fir; hickory; honey locust; hockberry; hard maple; mixed oaks; white pine; Pennsylvania yellow pine and walnut.

Based upon experience of various state highway departments the life expectancy of this type of fence is about ten years. There are, however, instances where these fences have lasted as long as twenty years with no treatment other than ordinary repairs and painting. Maintenance as a general rule consists largely of painting and replacing broken pickets. The life expectancy is of course prolonged by careful handling and proper storage during the summer months.

* Specifications may be obtained from the Department of Highways, Commonwealth of Pennsylvania, Harrisburg, Pennsylvania, upon specific request for the specifications for picket and wire fence. Enclose a stamped and self-addressed envelope.

These fences are hung on steel posts spaced about 12.5 ft as shown by Fig. 3. The standard post weighs about 1.44 lb per lineal foot and is six ft long with two hooks. These give adequate support and can be hooked on by one man.

In deep snow areas 8 ft posts with three hooks are used. The fence is hung on the lower two hooks in the fall and later raised to the two top hooks as the snow piles up.

Under no circumstances should the fence rest on the ground, for a space of from 6 in. to 1 ft is desirable underneath in order to keep snow from building up. In highway work two men can set about 1000 ft of this type of fence per day.

Life expectancy of steel posts is about 30 drivings provided they are not driven in hardpan or frozen ground, and, if not bent when pulled. These posts should always be driven with a proper driving iron fitting a particular post. The sledge or maul should never be used directly without proper capping on the post.

The second type of fence is the steel fence made from 26 gauge galvanized steel. The three board fence as shown by Fig. 2 is considered the general utility fence equivalent to the 4 ft picket fence. The cost is about double, but the life expectancy is double or triple or about 30 years. The weight per lineal foot is about 2.65 lb.

Aside from the long life, advantages claimed for this type of fence are: lower costs for setting up and taking down; small storage area requirements; fireproof construction; and positive availability because the fence has no other use and is not subjected to theft or borrowing.

Two men can set up from 2000 to 3000 ft per day. One mile of fence can be stored in the same space as four 100 ft rolls of picket fence. As a rule the three board fence is hung on 5 ft posts. Longer posts are used in deep snow countries in order to permit the bottom board being transferred from the top when the snow begins to fill in the trench.

In soft or swampy ground a brace and ground pin, as shown by Fig. 5, can be used to give additional support. These are also used with 8 ft posts and on ice where the longer posts are desirable in order to compensate for height as the weight of the snow sinks the ice.

Boards are normally set on 6 in. centers and posts spaced at 8 ft. This spacing is best where the fence can be placed 100 ft from the roadway. If the distance is less than 100 ft a 4 in. board spacing is desirable. For distances of from 50 to 75 ft, 2 in. spacing is desirable. This close spaced type is known as railroad fencing.

Steel board fencing should be slopped into the wind as shown by Fig. 5 in order to keep the space under the bottom board clear. Too little slant is preferable to an exces-

(Continued on page 82)

Fig. 4. The three board type is considered the general utility fence equivalent in effectiveness to the 4 ft. picket. Both types are used either continuously or in sections as shown above depending upon local conditions. In deep snow areas long posts are used, bottom boards later shifted to top

Photo, Pennsylvania Department of Highways

Fig. 6. Snow fences should be placed at least 100 ft. from the roadway to be protected so as to allow space for the drift formation on the lee side of the fence. Note the bottom of the fence is raised 8 to 12 in. above the snow level at the right and the good drift formation at the upper left

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Materials Handling Conference Shows Progress of Industry

SHADES OF THE past and ideas of the future, from the first conveyor installations in 1783 to the completely automatic factory of the future, were explored by an imposing list of authorities at Westinghouse's third biennial Materials Handling Conference in Buffalo, October 24 and 25. A. T. Gaudreau, management consultant, speaking at the final session of the conference, pointed out that fifty per cent of the entire shop payroll for productive labor in industry at large is chargeable to materials handling.

Mr. Gaudreau traced the evolution of industry and showed how the materials handling problem grew in parallel with the growth of complexity of industry itself; how it was necessary to consider plant layout and materials handling in a Siamese twin relationship. Both factors must be considered simultaneously when studying production costs.

Two other speakers, A. W. Lemmon, The Jeffrey Manufacturing Co., and A. D. Sinden, Stephens Adamson Mfg. Co. collaborated in a report on long conveyor tests for Riverlake Belt Conveyor Line, Inc., tests which were conducted on the overburden conveyor system in the South Agnew Pit of the M. A. Hanna Co., Hibbing, Minn. Equipment used to secure such tests was described in detail and the many problems which were met in the set-up and actual testing were covered.

Application of Hydraulic Couplings to Bridge and Trolley Drives, a paper which consisted largely of test procedure and results was presented by E. C. Rice, Whiting Corp.

While all of the papers were outstanding, many of them covered test data, top management problems such as export futures and handling of cement on inland waterways, or of military significance such as the one delivered by Harold Von Thaden, Hewitt-Robins, Inc., "Conveyors and the Problem of Military Supply." These we considered to be largely of academic interest to a large proportion of PLANT ENGINEERING's readers. Two, however, were of prime import to the plant engineering function. They are presented in detail, edited slightly because of space requirements, on the following pages.

Overhead Tiering with a "Stacker Crane"

By **FRED A. MILLER**, E. I. du Pont de Nemours & Co., Inc.

THE SO-CALLED "stacker crane," developed at du Pont, is an entirely new facility for materials handling.[1] It is called a stacker crane because the stacking feature of the fork truck has simply been attached to the trolley of an overhead bridge crane. It was developed to maintain storage capacity and, at the same time, to achieve the economies made possible by the fork truck and pallet system.

Realizing the need for new equipment to do this job, the du Pont Engineering Department devised and developed this scheme because no other type of available handling equipment studied would reduce this sacrifice of storage capacity. It was desired to develop a new method which essentially would retain the same inventories as obtained with hand stacking, or increase them.

To maintain minimum aisle widths, findings resulted in the theory that the mechanism must of necessity be suspended from above. Therefore, an overhead-supported rigid mast was devised, with a pick-up to improve space utilization over that of the fork truck system by reducing aisle widths required. The mast is attached to the trolley of a conventional overhead bridge crane. The rigid mast is secured to a turntable built into the bed of the trolley. A hoisting carriage with any type load-engaging device completes the development.

This mechanical arrangement makes possible the maximum accessible storage capacity for a given area. The operating aisle width required is approximately the length of the load plus 18 in. In the case of a four-foot pallet, the aisle required is therefore five and one-half feet.

Note in Fig. 1 that the shaded portion shown denotes a 52 per cent savings in the space required for the stacker crane. For one-column-deep pattern, the storage space ratio is of the order of 9 to 13.65.

To date, fourteen stacker crane installations are in operation or will be completed in the next five months. The units are employed as shown by the table.

	No.	Capacity	Type of Service
Item 1	2	1000 lb	storing rolls
Item 2	1	3000 lb	storing pallet loads
Item 3	2	1000 lb	storing rolls
Item 4	1	4000 lb	storing skid loads
Item 5	2	1000 lb	storing rolls
Item 6	1	1000 lb	storing pallet loads
Item 7	2	500 lb	storing drums
Item 8	3	3000 lb	storing pallet loads

All of the installations shown are, or will be, in du Pont plants except the last one noted. The two stacker cranes listed in the first item were installed in a new cellophane plant for storing 1000-lb rolls, on the basis of lower investment cost as compared with any previous system operating in older plants. A subsequent check of cost sheets showed that the new system was handling 1000-lb rolls at a savings of 60 per

[1] The American Monorail Co., 13123 Athens Ave., Cleveland, Ohio, has been licensed to manufacture the stacker crane.

From a paper presented at the third biennial Materials Handling Conference sponsored by Westinghouse Electric Corp., in Buffalo, October 24 and 25.

cent, as compared with the performance of the next best system. The two cranes listed as Item 3 were installed during a subsequent plant expansion after several years of satisfactory operation of the original pair. The roll-handling cranes listed as Item 5 were installed in another cellophane plant on the same basis. These results are accomplished by the fact that all necessary motions for storing rolls are motorized and operate by pushbutton from a single level. The only difference incorporated in these cranes is the substitution of a motorized roll core-engaging mechanism on the lifting carriage in place of the usual fork pick-ups. Rolls are stored to a height of 14 ft with perfect safety. Since all major motions are pushbutton actuated, it is possible to use female operators.

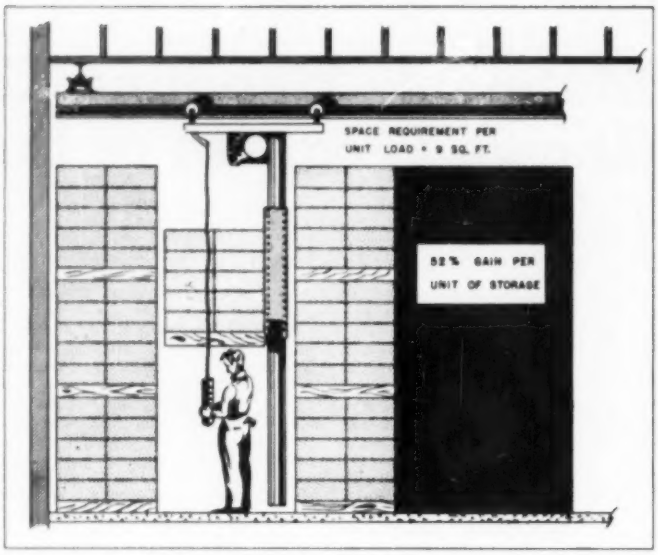
Increase in Storage Capacity

The stacker crane in Item 2 is in operation in a yarn plant, and was justified on the basis of a 58 per cent increase in storage capacity in an existing building. With the usual wide aisles, it would have been necessary to increase the storage area by approximately 180,000 cu ft of building construction.

The stacking crane noted for storing 4000-lb skid loads of finished products was approved on the basis of eliminating the need for doubling the size of the shipping area, which would have amounted to approximately 200,000 cu ft of additional building construction. The increase in storage capacity was gained by storing the skid loads two-high, the upper layer by stacker crane on steel racks—operating in the same aisle width (approximately 6 feet) required with hand jack truck operation for placing the lower layer. As the maximum loads approach 4000 lb, all motions, including the rotation of the mast, are motorized and controlled from a pushbutton station at floor level. It should be noted that this operation is not one of storage alone; a high-turnover shipping proposition of more than several hundred units per day is involved.

Item 6 was installed in a modernization program at one of the du Pont Photo Products plants, where it more than doubled the storage capacity in one of the existing buildings. The stacker crane used for this application has a rigid non-rotating mast, and the pick-up carriage is rotated at any elevation to the desired direction for storing the load in multi-deck steel racks.

The architects retained to design the new du Pont Experimental Station buildings near Wilmington submitted a proposed layout for solvent drum storage. Since any one of the five hundred units stored must be available without shifting others, the drums were placed on end and arranged in double rows with an operating aisle between. In the original design, consideration was given to a conventional method of storing which did not utilize the space most economically. The result was that in this first design a building 170-ft long and 60-ft wide was required.



Shaded portion of sketch shows the high degree of space utilization of the crane

An analysis by du Pont materials handling consultants using special storage racks and a stacker crane, indicated that a 42 per cent reduction in building size could be realized. This reduction not only paid for this equipment, but showed a substantial savings in investment dollars. Here again the stacker crane proved to be the most economical medium for efficient selective storage. Incidentally, a proportionate reduction is effected in the ventilating system necessary to remove hazardous solvent vapor from this building.

Explosion-Proof Construction

Both the storage and dispensing area stacker cranes shown in Item 7 are of explosion-proof construction. All motors, controllers, cable reels, and electric wiring meet the National Board of Fire Underwriters' Class I Group D specifications. Therefore, this feature of the stacker crane should be of particular interest to engineers in other industries where mechanization of handling operations has been restricted by the presence of highly combustible materials. With the stacker crane, palletized and other forms of unit load storage are entirely feasible. Flow of materials to and from the hazardous area can be handled by conveyors or by hand lift trucks.

The three stacker cranes noted in Item 8 of the tabulation have been purchased by a large outside company. They will be employed in a selective storage service to stack jet engines on pallets in steel racks. Here again, better space utilization more than justifies the cost of the installation.

Although the rigid mast stacker may be mounted on any type of overhead crane or double monorail carrier, existing installations have been made on underslung monorail cranes equipped with rubber tire traction drive units. This drive is most desirable for warehousing operations, because an error in maneuvering the load merely results in tire slippage instead of damaged merchandise! The bridge and trolley drives readily are adjusted to provide sufficient traction for normal movement, but insufficient to push over a stack.

The question of additional headroom requirements for stacker crane installations and the load effect on present steel building structures is anticipated. The answer to that is this: The overhead clearance for runway, crane, and stacker unit will range from 21 to 47 in., depending on capacity and span. This distance normally is required for spread of sprinkler heads and diffusion of the lighting, and therefore little, if any, additional building cost is involved. However, in special cases additional height may be required. If so, the cost of providing several feet of side wall construction is much lower than providing additional floor and roof construction.

Actually, alterations of this type were required on several of the installations noted and, costwise, still resulted in justifiable projects. The

load effect imposed on present building structures by stacker cranes is best answered by the fact that eight of fourteen cranes tabulated were installed in present buildings without any change in the steel structure.

To derive further benefits from the efficiency and economy of the stacker crane, present and future planning includes studies in other plants where many especially difficult handling problems have been recognized and have resisted solution for years. There are numerous plants where considerable stores of miscellaneous and maintenance items must be stocked for constant demand. These operations and many others now may be improved by the installation of the stacker crane.

In general, the stacker crane is applicable wherever selective and accessible storage is necessary and for special purpose propositions. Wherever a large number of items must be stored or withdrawn from stock, the stacker crane will be considered. Incidentally, the capacity of the stacker crane may be increased to 6000 lb or more and still operate in less than six-foot-wide aisles.

The stacker crane does not replace a fork truck storage operation where material can be stowed away in large solid blocks with minimum aisle access. However, should conditions change to require immediate access to any stack, consideration of a stacker crane is recommended on the basis of greater and more economical space utilization.

How to Evaluate a Crane Proposal

By **F. M. BLUM**, Manager, Overhead Crane Div.
Harnischfeger Corp., Milwaukee

THE AVERAGE PLANT engineer or purchasing agent, unless connected with a large company, will purchase no more than one or two cranes in his lifetime. These men really cannot make a study of crane construction and, therefore, must rely upon some means of coming to a decision. Such decisions usually are made upon the impression gained from the crane salesman's discussions of his proposal or the analysis of tabulation of competitive bids, or, thinking all cranes being equal, purchase is based on low price or on a price-per-pound basis.

Overhead traveling cranes are not purchased on the same basis as small tools, or, like automobiles, say for a five-year life expectancy. Overhead traveling cranes of the industrial type last for 40, 50, and 60 years. On production cranes such as magnet cranes, bucket cranes, or cranes having a definite duty cycle to perform each day, the average life expectancy is from 25 to 30 years. It can, therefore, readily be understood how the buyer could be misled to purchasing a piece of equipment on a low bid or on a price-per-pound basis which might be troublesome and costly to maintain for the entire life of the crane.

In the last two years, 32 per cent of all cranes purchased were bought on the low bid basis. It is unwise to pay too much. It is worse to pay too little. When you pay too much you lose a little money and that is all, but when you pay too little you stand a chance to lose everything, because the crane that you are buying may prove incapable of doing the very job that it was bought to do. The basic principles of business balance make it impossible to pay a little and get a lot. It sometimes may be advantageous to deal with the lowest bidder, but when you buy on price alone it is well to set aside a reserve as a matter of self-protection in case the crane should fail to meet your full requirements. Take the price quoted by the lowest bidder, add to it an amount of money sufficient to cover the chance you are taking, and you may find that the sum of the two is enough to buy known quality at the outset.

There are crane buyers who tabulate bids and buy on the price-per-pound basis. This is no longer an accurate way to judge the purchase of an overhead traveling crane. The modern crane today with many welded parts has been designed to produce a crane having a lower dead weight than its ancestors. As an example, a 20-ton, 65-ft. span crane built in the late 20's weighed 73,000 lb. A duplicate of that crane except for modern improvements weighs only 61,400 lb. Yet, this crane which has to lift 20-tons live load itself weighs over 30 tons. Therefore, it readily can be seen that modern trends are to reduce the dead weight of the crane, and correspondingly one should not purchase an overhead traveling crane on the basis of price per pound — no more than one would think of buying a milling machine or a boring bar on the basis of price per pound. You are not buying so much cast iron, nor so much structural steel. You are buying a machine tool to do a certain job.

It is, therefore, obvious that the only fair means of evaluating crane bids is by tabulation of certain pertinent features of the cranes. To give a true evaluation of the bid tabulation, however, a knowledge of some basic principles of crane design is necessary. Crane service classifications, as used by our sales and engineering departments to evaluate opinions where exactness of duty cycle is not possible to anticipate, are as follows:

Class 1 cranes are used for standby duty such as in powerhouses and motor rooms. This type of crane usually is provided with slow speeds because of occasional use involved in this type of service. The service life of the equipment is equal to the minimum operating standards and the maximum demand of full load lifts per hour in the neighborhood of 2 to 5.

Class 2 cranes are for light duty service, such as machine shops, warehouses, etc. In this instance, the moderate speeds and infrequent lifts call for service life of the parts and equipment to be comparable to the service expectancy. Maximum demand of full load lifts per hour is somewhere between 5 and 10.

Class 3 cranes are for moderate duty such as light foundry, storage yards, etc. With the average speeds and intermittent lifts encountered in this service, the service life of the parts and equipment should be equal to normal requirement. Maximum demand of full load lifts per hour is equal to about 10 to 20.

Class 4 cranes are for constant service, constant heavy-duty service such as encountered in heavy foundry work and production line cranes. With fast, constant operation, the

From a paper presented at the third biennial Materials Handling Conference sponsored by Westinghouse Electric Corp., in Buffalo, October 24 and 25.

Selecting Crane Equipment

The author of this paper collaborated with R. J. Wadd, consulting engineer, in the presentation, at the first Materials Handling Conference, of a paper on "Selecting Electric Traveling Crane Equipment for Service Performance." Mr. Blum has informed the editors that copies of this first paper are available to all qualified engineers. If you want a copy of it just write "Crane Selection Paper," on the postcard on pages 19 or 85 and drop it in the mailbox.

service life of the parts and equipment must be such as to equal the sustained service requirements. Maximum demand of full load lifts per hour equals somewhere between 20 and 40.

Class 5 cranes are for very severe duty, such as used for magnet operation, grab buckets, stockyards. Here, the fast and extra fast speeds together with steady use call for service life of parts and equipment to include rugged construction for maximum operating conditions. Maximum demand of full load lifts per hour is somewhere between 40 and 80.

These five classifications of cranes based upon the duties they are to perform best can be illustrated and translated into load ratings of the crane manufacturer's trolley and bridge drives. For instance, the typical loading on the 20-ton trolley frame for service classifications would be as follows: Class 1 — Standby Duty — 150 per cent of nominal load rating...30 ton; Class 2 — Light Duty — 125 per cent of nominal load rating...25 ton; Class 3 — Moderate Duty — Nominal load rating...20 ton; Class 4 — Constant Duty — 75 per cent of nominal load rating...15 ton; Class 5 — Severe Duty — 50 per cent of nominal load rating...10 ton. In other words, with a 20-t pattern trolley, the crane builder can build a 10-, 15-, 20-, 25-, or 30-t crane, depending upon the service for which the crane is desired.

Therefore, the crane builder, by proper selection of these capacity frames, will provide engineering designs for the entire field of crane capacities, and will be adequately covered for service requirements without having special or overlapping patterns, or by leaving service demand gaps. Such nominal ratings in frame sizes cover 5-, 10-, 20-, 30-, 50-, 75-, and 125-t pattern sizes. It is interesting to note in the selection of trolley patterns by the crane manufacturer that his nominal load rating for that particular trolley size, or for Class 3 cranes, the basic drum diameter for the cable used at that particular rating provides him a factor of safety of 5 on the cables, and provides him with a drum diameter that is at least equivalent to 30 rope diameters. Here, we have one of the basic principles of crane design—one of the vital factors in evaluating bids on overhead traveling cranes.

If we investigate further some of the basic principles of crane design, we will be in a better position to evaluate bids. For the bridge drive, the maximum wheel load on the crane and the speed determines the size of bridge wheels to be used. The physical proportions of the wheels will keep the loadings well within the permissible limits. The ratings on the individual wheels and bearings used on wheel axles do not vary too greatly between various

Tabular listing of highlights of two crane bids which might be received by the plant engineering department from competing manufacturers of crane equipment

	BIDDER A		BIDDER B	
GENERAL:				
1. Capacity	20/5 ton		20/5 ton	
2. Span	90'0"		90'0"	
3. Lift	35'0"		35'0"	
4. Total Net Weight	88,000 lb		77,000 lb	
HOISTS:	**Main Hoist**	**Aux. Hoist**	**Main Hoist**	**Aux. Hoist**
1. Hoist Speed	25 fpm	54 fpm	25 fpm	54 fpm
2. Hp of Hoist Motor and Rating	40 hp 30 M.—55 C	20 hp	40 hp	20 hp
3. Computed hp Required	39 hp	19.7 hp	39 hp	19.7 hp
4. Number and Parts of Rope	8 parts 5/8"	4—1/2"	8—9/16"	4—3/8"
5. Type of Wire Rope	6/19 Improved Plow Steel	6/19 Imp. Plow Steel	6/19 Imp. Plow Steel	6/19 Imp. Plow Steel
6. Dia. of Hoist Drum	20"	15"	15"	10"
7. Material in Drum	Welded Steel	Cast Iron	Cast Iron	Cast Iron
8. Type of Bearings	Hyatt Roller	Hyatt R.	Hyatt R.	Hyatt R.
9. Make & Type of Gears & Pinions	Spur Gears Welded Steel Pinions	Spur Gears Weld. St. Pinions	Spur Gears Weld. St. Pinions	Spur Gears Welded St. Pinions
10. Material of Gears & Pinions	Forged Steel Gears SAE-8630 Pin. SAE-8742 Heat Treated	Forged St. Gears 8630 Pin. 8742 Heat Tr.	Forged St. Gears SAE-1040 Pinions	Forged St. Gears SAE-1040 Pinions
	Hardened	Hardened	SAE-1045	SAE-1045
BRIDGE:				
1. Bridge Speed	300 fpm		300 fpm	
2. Hp of Bridge Motor & Rating	25 hp		20 hp	
3. Computed Running hp required	8.85		8.75	
4. Service Factor Used	2.83		2.29	
5. Girder Section at Center of Span	Top—28 x 3/4" Bot.—28 x 1/2" Webs—60 x 1/4"		Top—28 x 5/8" Bot.—28 x 3/8" Webs—54 x 5/16"	
6. Number & Diameter of Bridge Wheels	4—24"		4—21"	
7. Maximum Wheel Load	50,600 lb		44,000 lb	
8. Wheel Base	13'8"		12'3"	

The complete table and discussion of it as given by Mr. Blum in his paper is not presented here due to space limitations. The portion given, however, will serve to illustrate the principles under discussion.

manufacturers. However, the bearing sizes used for these wheel loads provide certain life hours which certainly should be taken into consideration in evaluating crane bids. It is our general practice to provide service life for the bridge and trolley drives for anti-friction bearing cranes, based upon certain load factors to obtain these bearing life hours. The following bearing life hours are used for various crane classifications: Class 1 — 3000 Hours Minimum — Load Factor 1.25; Class 2 — 5000 Hours Minimum — Load Factor 1.00; Class 3 — 15000 Hours Minimum — Load Factor 0.75; Class 4 — 30000 Hours Minimum — Load Factor 0.60; Class 5 — 50000 Hours Minimum — Load Factor 0.50.

The basic bridge wheel diameters are as follows: 15, 18, 21, 24, 27, and 30 in. Therefore, each of these wheel diameters has a bridge drive unit designed for it to provide a certain life expectancy under certain imposed wheel load conditions and bridge speeds. The diameter of the cross shaft and the diameter of the axles are proportionately designed to this wheel diameter and horsepower requirements and, most important of all, the bridge bearing life of the truck axle bearings is determined on the basis of the size of bearing possible to install on the truck wheel shaft. Therefore, from a machinery standpoint, we have the basis of judging and evaluating the bridge for our contemplated crane purchase. Briefly, then, let us tabulate the highlights of the bids and attempt to evaluate these bid items. For this tabulation, let us suggest a 20-ton "standard industrial crane" with a 5-ton auxiliary, 90-ft. span with a 35-ft. lift, to be used for machine shop service. Let us also assume that the current supply available is 230 volt dc. If we compare the hoist speeds for bidder A and B they are identical, 25 fpm on the main hoist and 54 fpm on the auxiliary hoist. The horsepower on the hoist motors and the rating of hoist motors also are identical. The computed horsepower required is identical for both bidders for the main and auxiliary. It is well to note here that that some variation exists, among manufacturers, in the computing of hoist motors, particularly in the assumed efficiency of the gear train and the efficiency of the ropes and sheaves. However, no great variation should exist, but in some cases it may fall within the difference between one motor rating and another. In all cases it is advisable to overmotor the crane in the hoist motion, rather than to undermotor.

In looking at the next item, number and parts of rope, we find that bidder A on his main hoist has provided 8 parts of 5/8-in. rope. In checking this, we find that the 5/8-in. cable is rated by the cable manu-

Class 2 cranes are represented in this photo. They are for light duty service in such places as machine shops and warehouses handling small heavy goods

facturers as being sufficient to hold 16.6 tons. This, times 8 parts of rope, and divided over a safety factor of 5 provides 24 tons for this $\frac{5}{8}$-in. cable, which is better than a factor of safety of 5, since the rated capacity required is only 20 tons. In case of bidder B, he is using 8 parts of 9/16-in. rope. This rope is rated at 13.5 tons, times 8 parts of rope, and divided by a factor of safety of 5, giving 21.6 tons—which is just within the factor of safety of 5. Checking back, then, we find that bidder A on the main hoist has actually a factor of safety of 6 on the ropes in comparison to a factor of 5 for bidder B. On the auxiliary hoist, bidder A has specified that he is using 4 parts of $\frac{1}{2}$-in. rope. This $\frac{1}{2}$-in. rope is good for 10.8 tons, times 4 parts rope, and divided by 5, indicating that the tonnage on this particular reeving is 8.64 tons. Bidder B has used $\frac{3}{8}$-in. rope, which has a tonnage of 6.3 per rope, times 4 parts rope, and divided by 5, indicating 5.04 tons. Therefore, it clearly indicates that bidder A has better than a factor of safety of 8 on the auxiliary hoist ropes, whereas bidder B has a factor of only 5. Both bidder A and B have specified 6/19 improved plow steel rope.

However, under Item 6, we again come to a very vital point in determining and making an analysis of our typical crane bid. Hoisting drums should be, as mentioned before, at least 30 rope diameters. The $\frac{5}{8}$-in. rope specified for the main hoist by bidder A means that a minimum drum diameter of $18\frac{3}{4}$ in. is required; therefore, the 20-in. drum that he has specified exceeds the 30 minimum rope requirements. Bidder B has specified a 15-in. drum and 30 times of 9/16-in. rope diameter is 16.86 diameter minimum requirement. Therefore, the 15-in. drum which bidder B has specified is less than 27 times rope diameter. Therefore, it clearly indicates that bidder A on the main hoist, from a standpoint of rope size and safety factor, is providing more crane than bidder B.

On the auxiliary hoist, bidder A has provided $\frac{1}{2}$-in. rope which requires a 15-in. diameter drum and he has specified it; therefore, the requirement to provide 30 rope diameters has been met. Bidder B has specified $\frac{3}{8}$-in. rope, which means that a minimum diameter of 11.25 is required for 30 rope diameters; the 10-in. drum which he has specified is less than 27 times rope diameter.

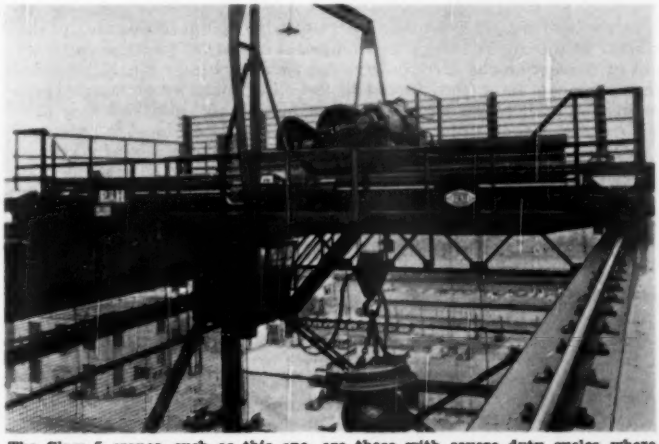
In Item 7 under Hoists, we find that bidder A has specified a welded steel drum for the main hoist and a cast iron drum for the auxiliary hoist. Bidder B has indicated that a cast iron drum is supplied for both the main and auxiliary hoist. Certainly, the welded steel drum that bidder A has specified is clearly a better mechanical unit than the cast iron drum specified by bidder B. This is because of the solid steel plate material under the rope grooves, requiring less material under these grooves than is normally required on a cast iron drum, providing a lighter weight drum and certainly a stronger drum.

Under Item 10, we note that the material of the gears and pinions under bidder A is SAE-8630 for the gears and for the pinions SAE-8742. This is a nickel alloy steel and, with heat treatment as specified, provides a tough, hard-wearing surface and a long-wearing gear. Bidder B has stated that he uses SAE-1040 for the gears and SAE-1045 for the pinions. This is a high carbon steel and is a good gear, but does not compare in quality with the nickel alloy steel gear provided for by bidder A.

Now, let us make a similar analysis of the crane bridge. We notice that under the bridge specifications the bridge speed for both bidders is 300 fpm. As to the horsepower of the bridge motor, here again we should take Items 2, 3, and 4 together, and we find that bidder A has provided a 25-hp motor and he has computed the running horsepower at 8.85, providing a service factor of 2.83. Bidder B, with a 20-hp motor, has a computed running horsepower of 8.75 and a service factor of only 2.29. Here again, we believe that the higher bridge motor factor used by bidder A is definitely an advantage.

Under Item 5, we find tabulated the girder section at the center of span. Bidder A has provided web plates of 60 in. in depth by $\frac{1}{4}$-in. plates, and has cover plates 28 in by 34 in. for the top and 28 in. by $\frac{1}{2}$ in. on the bottom. Bidder B has provided 54-in. deep web plates 5/16-in. thick. The cover plates are 28 in. by $\frac{5}{8}$ in. and 28 in. by $\frac{3}{8}$ in. The thicker cover plates from bidder A definitely gives him an advantage in that respect. However, as a rule of thumb to determine the minimum depth of web plates at the center of span, it should not be less than $\frac{1}{8}$ of the span. One-eighteenth of the span involved requires a 60 in. minimum web plate. Therefore, bidder

(Continued on page 80)



The Class 5 cranes, such as this one, are those with severe duty cycles where high speed and steady operation is normal practice in most industrial plants

NEWS.... IDEAS.... DEVELOPMENTS....

Products, plants, places and people of interest to plant engineers

Who Kicked the Wheel Off Mr. Willys' Jeep?

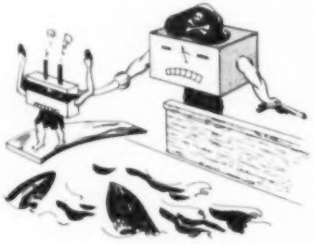
EVEN THE OLD, familiar Jeep is undergoing the process of change due to the exigencies of war-made needs. A lightweight, low-slung, extremely maneuverable, three-wheeled Jeep is being produced by a Philadelphia engineering firm to energize various types of jet planes. Developments by O. E. Szekely and Associates have resulted in a self-propelled electric power plant capable of furnishing constant d-c current. The Jeep has been modified in a number of ways. The rear end has been clipped off and a central dual steering wheel has been installed for the rear wheels. A shorter front axle has reduced the width of the vehicle. It is driven through the front wheels, which are not steerable.

Paint Spray School Days to Start Again

IT'S SCHOOL time at Binks Mfg. Co. again. Registration for 1951 classes is now underway; the school is held during the first full week of every month, except July and December, from 9 a.m. to 4 p.m. Classes are limited to 12 persons so that each obtains a maximum of personal instruction from men in charge. Furthermore, classes are composed of men with similar interests. Thus furniture men and automobile refinishers are in separate classes. Plant executives, engineers and supervisors are urged by the company to attend. One week of concentrated study under the supervision of William Beecham is said to familiarize students with construction and operation of spray guns, extractors, compressors and other related equipment. Each member of the class disassembles a spray gun and puts it together again. Special emphasis is laid on trouble shooting. Prospective enrolees write E. F. Watts, Binks Manufacturing Co., 3122 Carroll Ave., Chicago 12.

Calculating Machines to Do Away with Pilot Plants?

DR. C. C. HURD, director of IBM's applied science department, recently speculated, at a Seminar on Industrial Computation, on the possibility of solving an increasing number of industrial problems with the aid of mass-produced electronic calculating machines. Dr. Hurd noted that engineers have been forced to test their plans by erecting experimental or pilot plants which may cost $50,000 to build and may have to be run as long as two months at a cost of $1000 per day. "In practice," Dr. Hurd stated, "the pilot plant has been used because it has been cheaper to build such plants than to evaluate complicated mathematical formulas."



Canvas-Resin Helps Out in Steel Shortage

A NEW PLASTICIZED synthetic resin emulsion used as an adhesive with strips of light-weight canvas has been developed by Bigelow-Liptak Corp., Detroit, Mich., as a pinch hitter for boiler and industrial furnace covering. Called Texad, the material is said to improve air tightness, reduce enclosure costs, provide a completely weatherproof finish, and add to the attractiveness of the finished job. The covering seals the unavoidable shrinkage cracks in the finish coat of insulating cement. Outdoor boilers are completely protected against rain, snow and sleet. The material dries to a white finish, can be left as it is or painted.

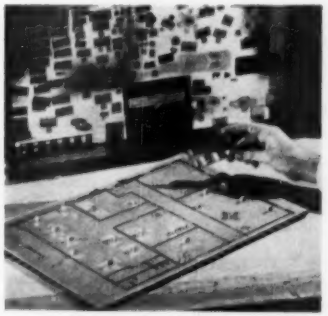
Modern Plant Roadway Lighting Shines at GE

WHAT IS BELIEVED to be one of the best lighted industrial plant roadways in the country was dedicated recently at G-E's River Works, West Lynn, Mass. Illuminating the area outside the main entrance to the Works are seven giant street lights measuring 21 in. in diameter and nearly a yard high. They are equipped with 25,000 lumen incandescent lamps providing 2.5 footcandles, almost 100 times as bright as full moonlight. Inside the gate, along Works Ave., are mounted 6 fluorescent and 5 mercury-vapor luminaires. Average illumination here is about 1.2 footcandles. Fluorescent fixtures are mounted 28 ft above the pavement, spaced 80 ft apart.

Putting in New Bridgework Not Always a Dental Job

ON ONE OF the most unusual bridge construction jobs in railroad history engineers for U. S. Steel's American Bridge Company had a dramatic moment, October 16th, when the first 518-ft-long span was rolled into place on the Illinois Central bridge over the Ohio River, near Cairo, Ill. The bridgeworkers will be working against time in order to get railroad traffic rolling as quickly as possible over the new span, first of twelve to go in on the mammoth job. The old span was shoved over to rest on temporary falsework and approximately 10 days later was launched into the river much as a ship is launched. One of the most unusual features of the construction project is that the new bridge is being erected, span by span, alongside the old structure.

Kit for Layout Plans and Prints



FLOOR PLANS for plants, offices or stores, including equipment placement, can be made to order with the use of a newly developed kit. Layouts are traced or drawn on a crosshatched sheet of transparent Vinylite plastic scaled ¼ in. to the foot. The layout is outlined on the grid sheet with either pencil or Scotch tape. Flat colored units of plastic, representing the equipment, are arranged and these are held in place by Alnico magnets. Sensitized paper is then slipped between the sheet and work board and exposed to ultraviolet ray lamps for three minutes. These lamps are built into the carrying case. Next, the exposed paper is removed and swabbed with developing fluid. No dark room is required and the prints are sharp and clear. The kits are made and distributed by Gross Engineering Co., Inc., Three Rivers, Mich.

Radar, "Domestic" and "Peaceful, Does Harbor Duty

THE MARINE Exchange lookout station at the end of Meigg's Wharf, foot of Hyde Street, San Francisco, is now equipped with a new Westinghouse marine radar set for harbor surveillance work. The long glass, used since 1901 to spot and identify ships entering and leaving San Francisco Bay, is fine when the weather is good, but the radar provides an accurate and reliable determination of the position of any object within range regardless of weather conditions, fog, rain or darkness.

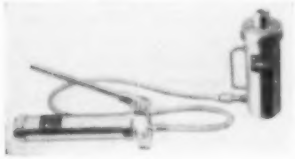
This installation of radar at the Marine Exchange station will provide valuable information about ship locations and movements, to expedite work in the harbor during periods of bad weather. Docking orders and mail can be dispatched swiftly to incoming vessels by the Marine Exchange launch, and information about ships can be transmitted more rapidly to owners, operators, suppliers, shipyards, governmental and other agencies.

NEW PRODUCTS summarized for your convenience

HYDRAULIC JACKS

For remote control lifting jobs where space is limited

The remote control hydraulic rams and pumps in company's new Re-Mo-Trol line were developed to operate where space limitations or other difficulties make the use of self-contained jacks impossible. These lightweight, portable units are designed to let the operator lift, pull or push from a distance — and in any direction, up, down, sideways or at an angle.



A center-hole tubular ram is used on the units of 30 to 100 t capacity, and this center hole lets the Re-Mo-Trol double as a puller. This center hole construction also simplifies rigging requirements on many jobs because the pull is always in a straight line and less effort is required.

Re-Mo-Trols will be available in seven models, from 10 to 100 t capacity. The pumps operate at a maximum of 10,000 psi with overload protection. Templeton, Kenly and Co., 1020 S. Central Ave., Chicago 44, Ill.

COLORED MARKERS

Can be applied to wire as a simple means of color coding

Suggested as an easy and inexpensive solution to the shortage of colored wire are Quik-Label Colored Wire Markers. These markers — available in 14 standard NEMA colors — are ¾ in. long and made of silicone treated cotton cloth with a pressure sensitive backing. They're intended to stick permanently to wire without moistening. W. H. Brady Co., 16 E. Spring St., Chippewa Falls, Wis.

COMBINATION STARTER

In fusible and non-fusible types, conforms to new JIC standards

A drip channel across top and around sides of this starter's steel enclosure prevents liquids spilled on the case from entering around the door, company points out, and the door is fitted with an oil-resistant Neoprene rubber gasket. Built in accordance with automotive manufacturer's Joint Industry Conference electrical standards for industrial equipment, the case contains no knockouts or mounting holes; outside mounting brackets are furnished.

The prescribed machine tool transformer, with 230/460-115 v multiple-rated primaries, is included. This heavy duty transformer has a built-in single-pole circuit breaker and self-contained terminal board. Also included in the starter is company's new a-c magnetic contactor with strongbox coil and vertical-lift contact assembly riding. The new disconnect switch mounts the fuses on the front. Up to four auxiliary interlocks for interconnecting circuits may be mounted. Circuits are color coded. Control Divs., General Electric Co., Schenectady 5, N. Y.

METAL SAFETY GOGGLE

Is strong and lightweight, available with or without side shields

Although primarily designed to protect eyes from flying particles, the F4100 Ful-Vue Goggle offers some increased comfort features and good looks, too. The lightweight eyewire is flat, with engraved beading, and the streamlined endpieces have a friction joint with wide bearing surfaces to minimize temple drop.

Perspiration resistant brown insulating tubing covers the ear portions of the temples and this tubing is sealed to keep out dirt. Extra strength is credited to the double-braced bridge, and easier adjustment to the longer guard arms that support the nose pads.

Optional side shields come in non-corrosive perforated wire mesh as well as plain or perforated clear acetate. Lenses may be changed without handling the side shields. Three standard eye sizes are available and five bridge sizes. The F4100 can be had with 6-curve Super Armorplate clear or Calobar lenses in three shades. Lenses may be prescription ground. American Optical Co., Southbridge, Mass.

AIR BLAST HEATERS

For electric heating of extremely large volumes of air

Individual Chromalox Finstrip Heaters are assembled in banks to form sections of various sizes which are welded

into one large frame for mounting in air ducts. The heaters have Monel sheaths and fins to prevent corrosion by moisture-laden air and metal parts of frame are primed with a rust-prevention undercoating before painting with black, baked-on heat resisting enamel.

One of these heaters, rated at 440 v, 192 kw, is composed of four separate removable quadrants of 48 kw, each having eight distinct circuits for stepped modulation. Provision for thermal cutout and thermostatic controls can be made. Edwin L. Weigand Co., 7553 Thomas Blvd., Pittsburgh 8, Pa.

NON-SLIP FLOOR FINISH

Is self-polishing; dries to form a lustrous, long-wearing surface

A new type of floor finish, Whiz Check-Slip is applied and cared for like wax, but contains no wax — it's a plasticized resin which protects the floor by covering it with a hard, continuous film that's glossy and highly slip-resistant.

You can use Check-Slip on practically all floors — asphalt or rubber tile, terrazo, linoleum, or wood. Apply it to the clean floor and it dries within 30 min; it's ready for damp mopping in 48 hr. According to manufacturer it won't craze, get brittle or become sticky even in hot, humid weather.

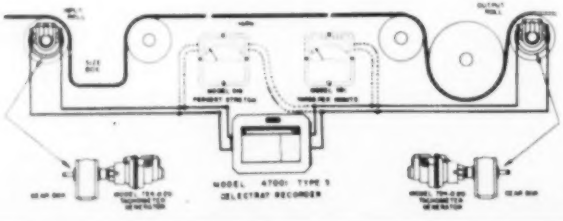
Since it's a water emulsion, Check-Slip is non-inflammable, and it can be diluted with water for an economical second coat. Company says the usual floor cleaners will remove Check-Slip.

RECORDING STRETCH METER

Is designed to automatically indicate, record changing speed ratios

The percentage of stretch or shrinkage of materials being processed through pairs of rolls turning at different speeds is indicated and recorded by the new Tag-Weston Recording Speed-Ratio Tachometer. It provides a continuous record of roll speed for textile, paper, plastics, rubber, chemical and metal-rolling industries.

Operated by two tachometer generators driven by the rolls, the new instrument incorporates company's Model 47001 Celectray ratio recorder. It can be calibrated in per cent stretch as in yarn processing, inches per yard shrinkage as in fabric Sanforizing, percentage reduction as in metal rolling, or other units. Its application to a slasher in a textile mill is illustrated. Various calibration ranges and chart graduations are available. Tagliabue Instrument Corp. Dept. 414, Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.



doing this *costs more* now!

You do it less often

by using Dependable Quality

CRANE VALVES

That's why more Crane Valves are used than any other make

. . . this valve likes tough throttling jobs

—And for durable, maintenance-free service, it's typical Crane quality. The plug-type disc and seat construction in Crane No. 14½P's utilizes the toughest combination of metals found in 150-Pound brass valves. Extra wide seating surfaces give high resistance to damage by "wire drawing" or foreign matter. Crane disc taper is precisely correct for accurate flow regulation.

Whether you need throttling valves or any other type, you'll pay less in the long run by insisting on Crane Quality. Get a demonstration by your Crane Representative.

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CRANE CO., *General Offices:*
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VALVES • FITTINGS • PIPE • PLUMBING • HEATING

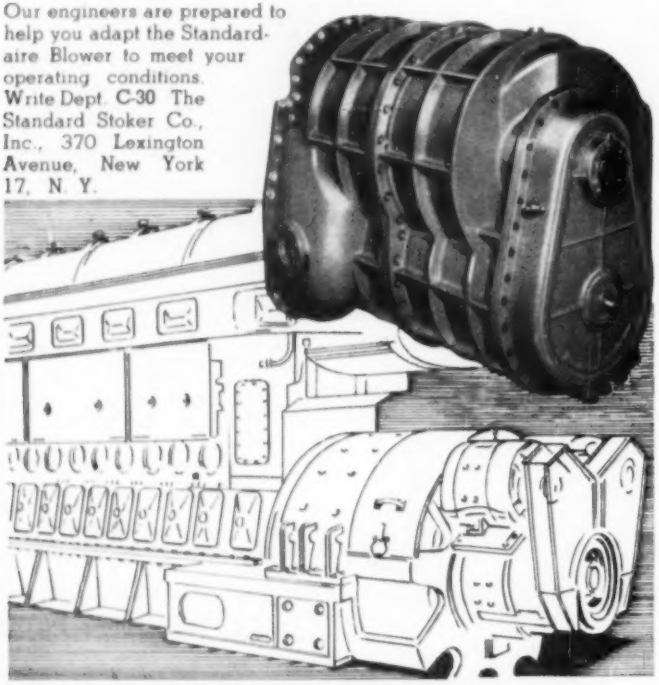
FOR INCREASED DIESEL OUTPUT

The STANDARDAIRE Blower

The Standardaire Blower with its unique features of design assures outstanding operating results whether for diesel service or for its many industrial applications. Service tested Standardaire Blowers have proved they operate with exceptionally high adiabatic and mechanical efficiencies at greatly reduced blower horsepower requirements. Their "air screw action" also eliminates shock delivery of air. This feature combined with high adiabatic efficiency means a relatively cooler discharge air temperature, resulting in increased cylinder charge density for a given cylinder volume and pressure. The net gain — greater horsepower per pound from your diesel engine.

Another feature—*lower noise level.* Unbiased tests prove Standardaire Blowers have 8 to 15 decibels lower noise rating than comparable blowers of the positive displacement type.

Our engineers are prepared to help you adapt the Standardaire Blower to meet your operating conditions. Write Dept. C-30 The Standard Stoker Co., Inc., 370 Lexington Avenue, New York 17, N. Y.



THE STANDARD STOKER CO • INC •

Standard Stoker SSC

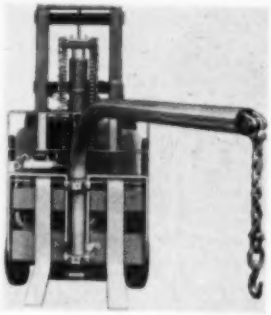
NEW YORK • CHICAGO • ERIE • YORK • MONTREAL

but clear water used in wet mopping won't affect the finish. Worn patches can be re-coated. Comes in 1, 5, 30 and 55 gal containers. Industrial-Aviation Div., R. M. Hollingshead Corp., Camden 2, N. J.

SLEWING CRANE ARM

For quick, easy loading of crated materials in box cars

Developed for positioning of loads up to 800 lb at 80 in. load center, and for use with company's lift trucks, this slewing crane arm



is pivoted so that a two-way hydraulic cylinder can swing it laterally 20 deg to either side of center. It is readily detachable, so truck can be used with pallet forks. Towmotor Corp., 1226 E. 152nd St., Cleveland 10, Ohio.

PAINT REMOVER

For wood or metal surfaces, is quick acting, non-inflammable

Kurl-Off is a clear, colorless liquid for quickly lifting off paint, varnish, shellac and most lacquers. It works by dissolving the finish chemically, working down to the bare surface. It won't harm the wood, company states, and within 15 minutes the old finish can be whisked off.

Kurl-Off can be used on metal, too. It is claimed to be non-corrrosive, non-staining, and non-inflammable, and no neutralization or after-rinse is required. Hillyard Chemical Co., St. Joseph, Mo.

SOCKET WRENCHES

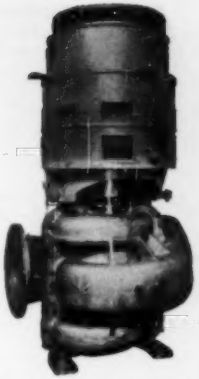
Single hexagon, thin wall type for use in restricted areas

Having thin walls, these single-hexagon (6-point) sockets can be used in restricted areas wherever corresponding double-hexagon (12-point) types will fit, and although thinner than regular power sockets company guarantees them for power or hand use.

Single hexagon sockets are said to be particularly useful because they fit and turn undersize nuts as well as those that are rusted or damaged. They permit safe work on stubborn nuts without slipping, company points out, and they don't chew up brass or other soft nuts. Made of alloy steel with chrome finish, the 6-point type socket design is claimed to wear longer because of its increased strength. Twenty sizes are offered, including seven $\frac{3}{8}$ in.

Longer life in severe service from

MONEL
"K" MONEL
PUMP PARTS



24-inch main condenser circulating pump with a capacity of 15,000 g.p.m. at 25-foot head. Shafts are heat-treated "K" Monel.

Corrosion, erosion, wear, fatigue . . . pump parts must stand up to *all* these destructive forces if satisfactory service is to be achieved.

In particular, where corrosive liquids must be handled . . . salt water, crude oil, chemical solutions . . . the selection of proper material often spells the difference between weeks and *years* of service.

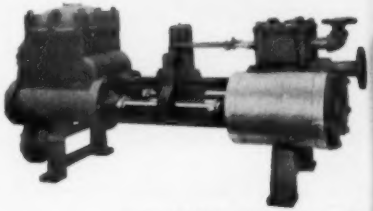
Leading makers and users of pumping equipment have found that pump life can be greatly extended, often tripled and quadrupled, when vulnerable parts are made of *Monel*® or *"K"*® *Monel*.

These two INCO alloys are highly resistant to corrosion by salt water and most commonly-encountered industrial chemicals. In addition, they possess strength and hardness equal to those of structural steel. Both alloys are machinable, and both are available in standard mill forms. Moreover, Monel is readily castable.

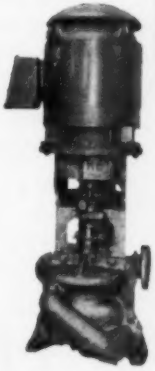
"K" Monel differs from *Monel* in that it may be heat-treated to attain maximum properties, either before or after machining. This feature makes *"K" Monel* an ideal metal for shafts, sleeves, and other highly stressed machine members, while *Monel* is at its best in impellers, valve parts, strainers, and piping.

The International Nickel foundry at Bayonne, N. J., has been casting Monel pump parts for more than 40 years. Among recent technical advances is an improvement in the as-cast surface of sand castings. Shrouded impellers, for example, are now cast with a surface so smooth that pump manufacturers report up to 75 per cent less labor time required for hand filing. The Inco foundry can also supply centrifugal castings for shaft sleeves, cylinder liners and pump rings.

For further information on cast Monel impellers and other Monel pump parts, write to R. F. Johnson of INCO. Ask for your copy of *"How to Get Longer Service from your Pumps."*



Horizontal duplex low-pressure feed pump, 7½ in. by 5 in. by 10 in. Operating pressure is 250 psi. Piston rods and valve rods are Monel.

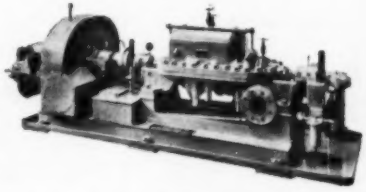


3-inch main condensate pump handling 225 g.p.m. at a head of 180 ft. Impellers are Monel, cast at Inco's Bayonne foundry.

2-inch condensate and drain transfer pumps, handling 100 g.p.m. at a 140-ft. head. Cast Monel impellers were produced by Inco's Bayonne foundry.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

All pumps illustrated were manufactured by: WARREN STEAM PUMP COMPANY, INC. Warren, Mass.



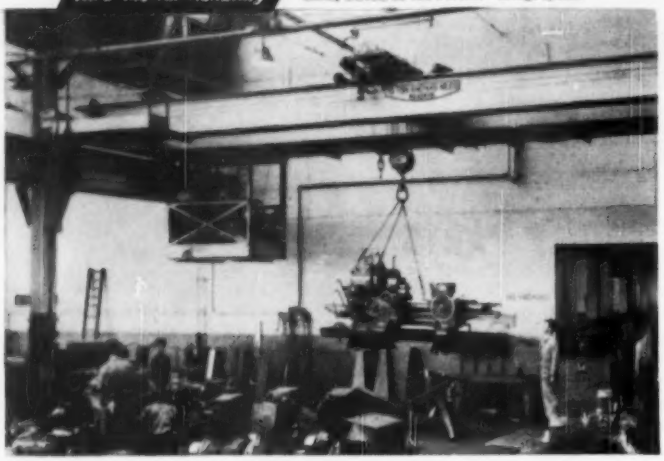
EMBLEM OF SERVICE INCO TRADE MARK

2½-inch, six stage feed pump, driven by a 210 H.P. turbine. Pump delivers 300 g.p.m. of feed water at a discharge pressure of 725 psi, equivalent to a head of 1770 ft. Shaft sleeves are Monel. Impellers are cast Monel, produced by Inco's Bayonne foundry.

MONEL . . . *for Minimum Maintenance*

For Lowest Cost Per Load-
Use Dependable
Thru-the-Air Handling

For this installation, operating conditions called for rapid travel over a large area. Controlled by operator in the cab, this Shepard Niles 10-ton, welded-beam crane, with main and auxiliary hoist units, travels at 450 F.P.M.—bridge speed.



we start by asking "what"

WHAT are *your* problems? Under WHAT conditions will *your* crane be operated—intermittently, or under fairly constant conditions? WHAT are the operating speeds necessary to meet *your* productive cycle?

Your answer to these and similar questions will enable us to engineer your installation so that it will give you the best, and longest service—at the lowest cost per load over the years.

Be sure you get the crane best qualified to do *your* job. It's wise—and costs you nothing—to get the facts first, rather than to make expensive changes later.

May we place our experience of a great many years of successfully designing all types of crane installations at your disposal?

Shepard Niles

CRANE & HOIST CORPORATION

Makes and sells all three lifting tools for airborne shop loads

CRANES • Overhead

HOISTS • Cab Operated

HOISTS • Floor Operated

474 SCHUYLER AVENUE • MONTOUR FALLS, N.Y.

drive regular sockets; six ⅝ in. extra deep sockets; and seven ½ in. drive regular sockets. Plomb Tool Co., 2209 Santa Fe Ave., Los Angeles 54, Cal.

PORTABLE POWER SAWS

For fast, easy cutting of concrete and asphalt floors, runways

These saws are designed to cut straight smooth edges before breaking, and are suggested for use in small patching jobs as well as production sawing. Cutting speed is 12 fpm in asphalt, and up to 5 fpm (1 in. deep) in limestone concrete. Maximum depth of cut is 6½ in. Metal bonded diamond blades are available for sawing concrete with limestone, flint, or granite aggregate.

For heavy duty applications, the gasoline powered Models C-75 (7½ hp.) and C-130 (13 hp) are recommended. Models C-15 and C-20 have electric motors and are intended for plumbing, electrical and maintenance applications. Clipper Mfg. Co., 2800A Warwick, Kansas City 8, Mo.

REVOLVING ROLL CLAMP

For safe, rapid handling of rolls of paper, cylindrical objects

Designed primarily for handling rolls in and out of box cars, trucks and storage areas, this attachment will grip a roll weighing up to 2800 lb and rotate it 360 deg in either direction. Rolls can be picked up from either vertical or horizontal position and deposited in either position.

The revolving feature also lets the clamp pick up and deposit rolls against walls at either side of the truck. Rolls with minimum widths of 32 in. and diameters from 30 to 44 in. can be accommodated. The attachment has one stationary arm and one hydraulically-operated arm which moves laterally from closed position of 29 in. to fully

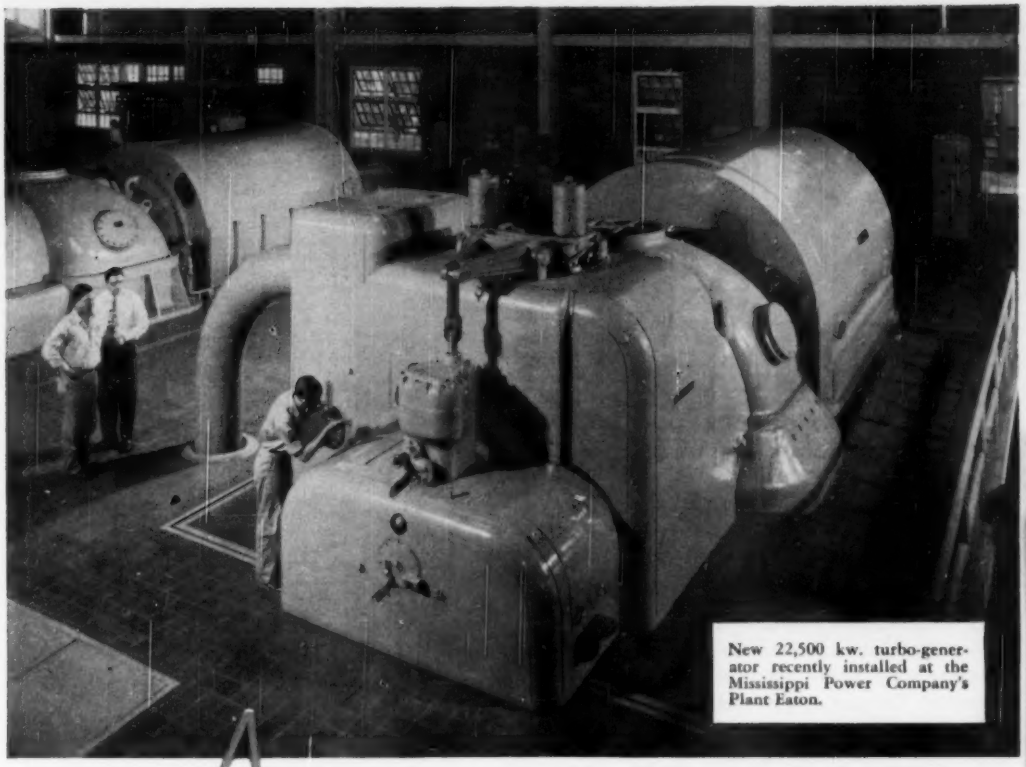
MAGNETIC SEPARATOR

For removing stray iron from liquids in large pipes

The Liquid Pressure Hump is described as a pressure-tight non-electric magnetic seperator; its purpose is to keep tramp iron from damaging such processing equipment as refiners, pumps, grinders. A flow interrupting unit, it is designed to remove stray iron from liquids, slurries and slips flowing in pipelines from 6 to 20 in. dia.

In operation, strategically placed baffles direct material flow 30 deg

from the normal straight line, so the two stainless steel magnets on opposite sides of the hump can set up magnetic barriers in tandem — what one misses the other can catch. This unit performs satisfactorily with material flowing at 50 to 250 cfm, company states, depending on consistency, and pressures to 45 psi. Eriez Mfg. Co., Erie, Pa.



New 22,500 kw. turbo-generator recently installed at the Mississippi Power Company's Plant Eaton.

Another progressive utility selects Gulfcrest Oil for new turbine unit

Another new turbine gets the safe, sure, long lasting protection of Gulfcrest, now more than ever the world's finest turbine oil!

Another case, too, where outstanding performance in other turbines operated by the same utility led to the selection of Gulfcrest Oil for the new units.

Extra refining makes the difference! After the carefully selected crude oil used in Gulfcrest goes through the major refining methods, it is then supperrefined by the Alchlor Process.

As much as 15 per cent of the oil is discarded by the Alchlor Process—this 15 per cent contains the hydrocarbons most apt to oxidize and form sludge, emulsifiers, and harmful acids.

That's why Gulfcrest is incomparably pure—why it gives outstanding performance, and lasts indefinitely. Call in a Gulf Lubrication Engineer today for complete information on this superior oil. Write, wire or phone your nearest Gulf office.

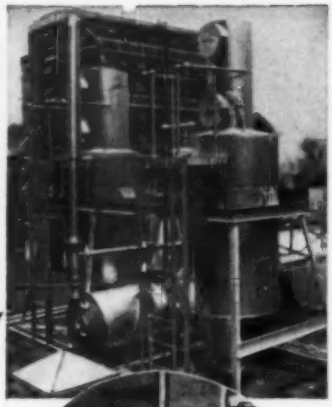
Gulf Oil Corporation · Gulf Refining Company

GULF BUILDING, PITTSBURGH, PA.

Sales Offices - Warehouses
Located in principal cities and towns throughout Gulf's marketing territory

GULF INDUSTRIAL LUBRICATION

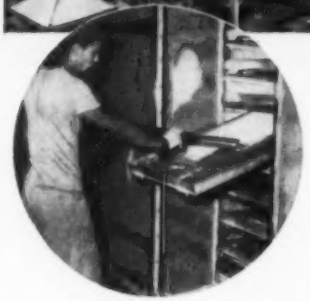
Spencer Vacuum Equipment on roof of chemical plant



"*Processed by*

SPENCER VACUUM"

That might well be the expression applied to the entire operation of blending, mixing, sorting and packaging in this large section of a well known chemical plant.



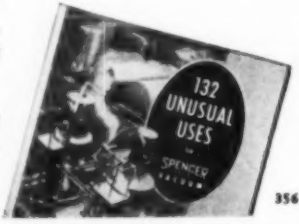
Emptying Trays

The major credit however is due to the Chemical Plant Engineer who realized that Spencer Vacuum could pick dried plastic granules out of the oven trays and elevate them to the roof by the ton.

He also realized that by picking up two different lots at the same time, they would be mixed automatically in the Spencer "Separator" on the roof. Then gravity did the rest, through vibrating screens and other devices, and then into bags in the shipping room on the first floor.

And this is only one of the "Unusual Uses" illustrated and described in the new 24 page Spencer Bulletin. It shows how industrial engineers apply vacuum to remove liquids, gases, powders, metal scraps, and hot materials. It gives diagrams showing applications such as unloading freight cars, and bottling milk. It illustrates how the machinery designing engineer has improved equipment for making hats, pills, textiles, and for calculating machines.

Ask for the bulletin and see where and how Spencer fits in your plant.



356-C

THE SPENCER TURBINE COMPANY • HARTFORD 6, CONNECTICUT

SPENCER
HARTFORD

opened position of 45 in. between pivoted clamping shoes. Opening and closing is controlled by a valve placed near the operator. Towmotor Corp., 1226 E. 152nd St., Cleveland, Ohio.

ELECTRONIC FLOWMETER

Is designed to handle difficult problems of flow measurement

This instrument is suggested for measurements involving high capacity, corrosive liquids, acids, gasses and liquid oxygen. It comprises a flow sensing unit with dynamically balanced rotor and magnet rotating within a non-magnetic housing and an external pickup coil connected to an electronic integrator or totalizer or both.

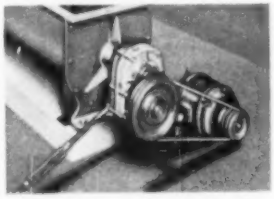
The sensing unit is usually housed in a standard AN fitting no larger than the line in which it's installed. Fluid passing through turns the rotor at a speed determined by the velocity of the liquid and speed of the rotor blades. A cylindrical Alnico magnet sets up a rotating field which generates a-c current in the pickup. This current is conducted to an electronic unit which either integrates it into d-c current for operating a rate-of-flow meter, or counts and totals the cycles on an electro-mechanical counter.

According to manufacturer, the sensing unit needs little maintenance — its plastic bearings are self-cleaning and corrosion resistant and the only limitation to foreign materials in the flow is the size of the particles which can pass between rotor blades. Standard sensing unit sizes range from ¾ to 3½ in. Potter Aeronautical Co., 87 Academy St., Newark, N. J.

TORQUE-ARM REDUCER

Single-reduction unit; output speeds of 115 to 330 rpm

Ease and economy of installing this new reducer are attributed to its shaft mounting. This, according to manufacturer, eliminates special engineering, the cost of a foundation, flexible couplings, sliding base, and the job of lining up. The compact unit is locked to the driven shaft by two steel collars, one on each side of the reducer. It is anchored to the floor, or any fixed object, by the torque arm.



Available in four sizes covering capacities to 27 hp., this reducer can be driven through any V-belt drive, although its designers recommend use of company's stock sheaves. Flat-belt drive can also be used. Belt tension is adjusted by a turnbuckle in the torque arm. Transferring unit from one machine to another is simplified by use of interchangeable shaft-keyed bushings. Dodge Mfg. Corp., Mishawaka, Ind.

HERE ARE 4 TYPICAL APPLICATIONS

All the production short cuts shown on this page have been supplied by plant engineers, electricians and tool designers who have found MICRO precision switches ideal in making present plant equipment more automatic, safer and more convenient to operate.

There are hundreds of such applications in MICRO SWITCH files. Plant production men are invited to send for a file of MICRO TIPS, a publication devoted to these practical, time-saving ideas. Better still, let us put you on our list to receive MICRO TIPS regularly.

MICRO

Precision Switches for PRODUCTION SHORT CUTS

MICRO SWITCH distributors with complete stocks are located in over one hundred cities to supply you with just the right switch to make your plant operations more automatic. Look for them under "Switches, Electric" in your classified phone book.

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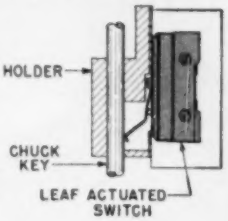
TRADE MARK
DIVISION OF MINNEAPOLIS HONEYWELL REGULATOR CO.
FREEPORT, ILLINOIS, U.S.A.

Copr. 1950, Minneapolis-Honeywell Regulator Co.

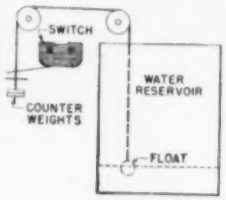
Branch Offices in Principal Cities of the United States and Canada

❶ MICRO precision switch insures safe drill press operation.

This drill press cannot start until the chuck key is removed. A normally-open snap-action switch in a special holder with mounting plate is attached to the column of the drill press. With the switch wired into the motor starting circuit, the press cannot be started until the chuck key is removed from the chuck and is inserted in the holder.



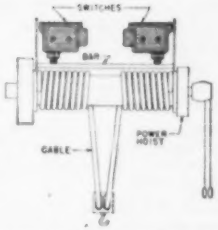
❷ MICRO precision switch signals when reservoir water is too low.



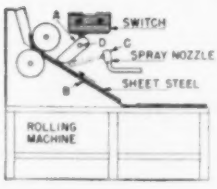
Low water level in a large concrete water reservoir is indicated by a snap-action switch with a leaf type actuator. When the float drops to the predetermined level, counter weights actuate the switch. In such an application the switch can either be used to operate a signal light or be wired into the motor starting circuit to start the pump.

❸ MICRO precision switches stop power hoist should cable become overlapped.

Should this hoist be raised too high and cable overlap, these two snap-action switches are wired into the motor circuit to stop the hoist and to ring an alarm bell. Their use in the application protects against breakage of the hoist or the cable with possible damage to the load.



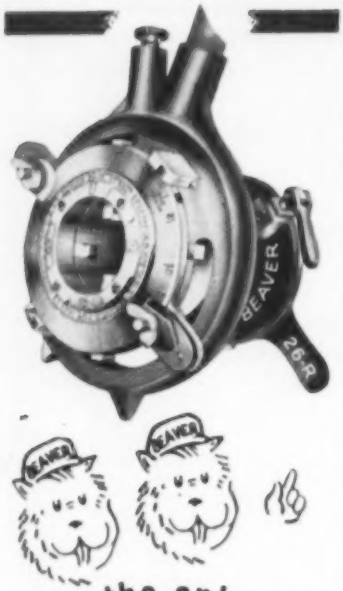
❹ MICRO precision switch operates oil spray as sheets enter forming rolls.



This snap-action switch is used to operate the spray gun which sprays soluble oil on steel sheets just before the sheets enter the forming rolls. Thickness of the sheets on the conveyor operate the switch through actuator "A", which is pivoted at "D". Spray gun is thus operated only for the period desired and disconnected as the sheet passes on into the rolling machine.

MICRO . . . first name in precision switches

BEAVER 26-R



the only tool of its kind that . . .

. . . cuts either standard "taper" or electric "straight" conduit threads by a simple adjustment.

. . . has "radio" dial size-setting. Dies can be removed in a few seconds FROM THE OUTSIDE without use of tools.

. . . is fully-adjustable and easy-working. The only 1 to 2-inch pipe threader that cuts standard, oversize and undersize threads of uniform standard length.

The Beaver 26-R uses one set of dies to thread four sizes—1, 1¼, 1½ and 2-inch. It is fully-adjustable for oversize or undersize threads to compensate for variation in fittings. There's a cam-type universal self-centering chuck, too, which centers the pipe accurately and insures straight pipe lines. Yet, "drip threads" may be cut when desired for heating lines.

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BEAVER PIPE TOOLS
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NEW BOOKS

for the plant engineering staff

How to Find Your Bearings

BIBLIOGRAPHY ON NON-METALLIC BEARINGS. ESL Bibliography No. 6. Size 8½ by 11 in.; 13 pp; stapled; paper cover. Compiled by Engineering Societies Library, 29 West 39th St., New York 18, N. Y. Price $2.00.

THIS ANNOTATED bibliography of 101 selected references to the literature of the past twelve years covers all aspects of non-metallic bearings.

Such information as the manufacture, design, properties, wear, lubrication, performance, testing and applications of bearings is supplied. Particular reference is made to bearings made of rubber, wood, laminated phenolic plastics, resin-impregnated cotton fabric, micarta and nylon.

Applications discussed are for rolling mills, marine propeller shafts and rudder posts, automatic presses, axle bearings for railroad rolling stocks and agricultural machines.

Handbook for Plant Engineers

PLANT ENGINEERING HANDBOOK. Edited by William Staniar. Size 6 by 9 in.; 1,955 pp; 1,487 illustrations; 544 tables; flexible leather binding. Published by McGraw-Hill Book Co., Inc., 327 West 42nd Street, New York, N. Y. Price $15.00.

THIS HANDBOOK tells how to manage, operate and maintain industrial plants, and presents the essentials of good plant engineering practices in 76 major areas of plant operation and maintenance. It is designed to meet the needs of plant engineers, plant maintenance engineers, plant managers and plant superintendents—the men responsible for efficient and economical operations and production in industrial manufacturing plants.

William Staniar, editor-in-chief, and the 86 contributing authors, each a nationally recognized authority in his respective field, have worked for 5 years to complete this handbook. It deals with industry's consumption and conservation of basic resources, with management engineering, with industrial construction, fire protection, maintenance, with industrial power and its uses, with air handling, materials handling, and the handling of services.

There are 35 chapters containing such subjects as foundations and reinforced concrete; industrial water purification and treatment; industrial instrumentation and control; materials handling; heat transfer; metallurgy and corrosion; and many others.

This is an excellent reference

More than a HALF-BILLION gallons of fuel oil have been treated with HOUGHTO-SOLV to remove sludge

. . . and in each case users gain not only higher heating efficiency but also sizable savings *in hard cash!*

Messy, laborious sludge cleaning jobs have been eliminated . . . for example, nearly $2,000 was saved in just one instance by the application of Houghto-Solv.

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Philadelphia 33, Pa.

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Write, or call the Houghton Man, for this descriptive folder which gives complete data on this speedy fuel oil solvent.

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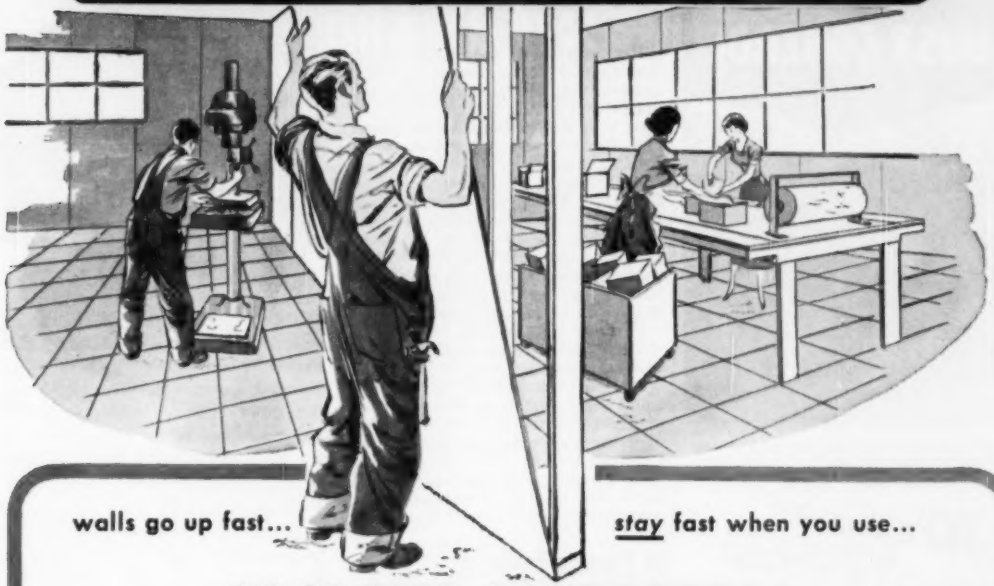

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Tempered Presdwood—tempered to extra hardness, greater strength, abrasion and moisture resistance. Thicknesses: $\frac{1}{8}$", $\frac{3}{16}$", $\frac{1}{4}$", $\frac{5}{16}$".

Panelwood®—a low-cost panel material for walls and ceilings. $\frac{3}{16}$" and $\frac{1}{4}$" thick.

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4. Bins and chutes—*Tempered Presdwood*
5. Pallets and trays—*Tempered Presdwood*
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book to be thumbed through to obtain valuable finger-tip information on subjects close to the grindstone of the plant engineer.

On Managing Small Plants

SMALL PLANT MANAGEMENT. Edited by Edward H. Hempel. Size 6 by 9 in.; 499 pp; cloth bound. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price $6.00.

PREPARED UNDER the auspices of the American Society of Mechanical Engineers, this book shows how small plants fit into the economic picture, how they are set up and operated, and the over-all opportunities for small plants both here and abroad.

As the title of the book implies, this treats the management end of a small plant, discussing such subjects as: financing and banking; top management planning; legal requirements; getting along with the union; how to get best productivity; how to save in taxes; and others.

Each of the twenty chapters is written by an expert in his special field. For any person contemplating operation of or already operating a small plant this book should prove of great assistance. Comparing and applying the techniques and methods indicated in the book to your own management procedures will point the way to improved plant organization and output.

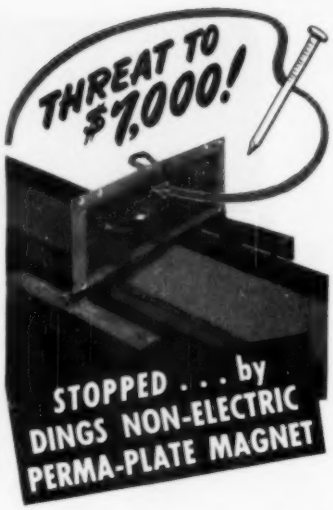
On Planning Production

PRODUCTION PLANNING AND CONTROL by Thomas M. Landy. Size 6 by 9 in.; 436 pp including index and appendix; illustrated; cloth bound. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price $5.50.

THE FUNDAMENTAL principles and laws outlined in this practical book will help toward a more economical and smoother functioning of your production planning and control system.

It tells you exactly what production planning and control is, and how it is installed and operated. It shows how to coordinate the whole system; how to determine at what cost to manufacture or assemble a product efficiently; the best way to order, expedite and issue tools; how to provide the right kind and quantity of material at the right time; and how to ensure sound, low-cost operation.

The material is presented in three parts. Part I, Installation and Operation, deals with the problem of installing modern production planning and control as well as planning an organization to operate the system efficiently after the installation has been completed. Part II, Principles and Functions, is a declaration of the principles and laws governing the subject, as well as a detailed



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For installation in wood or metal chutes, ducts, pipes, conveyors, spouts, etc.

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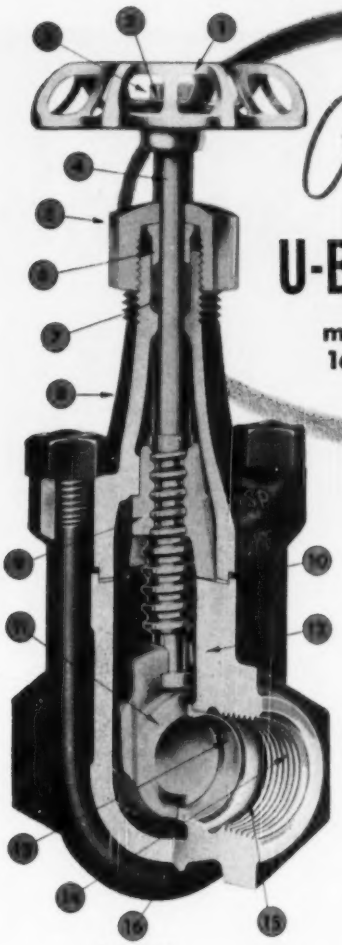

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14. Full Length Pipe Threads
15. Liberal Diaphragm Clearance
16. Strong U-Bolt

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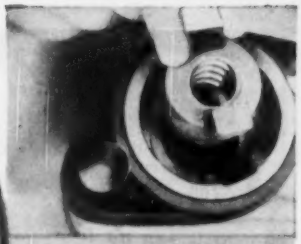
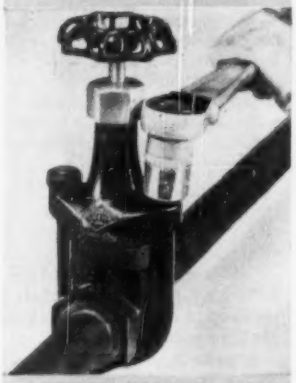
Screwed	Flanged
150 lbs. Steam	125 lbs. Steam
225 lbs. O.W.G.	175 lbs. O.W.G.

Bronze Mounted or All Iron—Sizes ¼" to 3"



BONNET SAVER BUSHING — No need to junk the bonnet when operating threads are worn. Just slip in a new, patented "Bonnet-Saver Bushing" and have good-as-new thread engagement.

EASY TO CLEAN — You can really get into the bonnet of this valve to clean out the chamber above the operating threads.



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TROUBLE IS RULED OUT! Check these 16 advanced features—for wear-resistance . . . for ease of maintenance. From handwheel to diaphragm, notice how thoroughly trouble has been ruled out in designing this U-bolt valve. No other valve in its class measures up to Jenkins U-bolt Gate on all these points, many of them exclusive.

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For "renewability" without waste, bull-necked endurance, and low upkeep cost, you can't beat Jenkins U-bolt Valves. Yet they cost no more! Full details and specifications in new circular, Form 179-B. Jenkins Bros., 100 Park Avenue, New York 17. Jenkins Bros. Ltd., Montreal.

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100-1 MAINTENANCE FOR METAL

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analysis of the various functions. In Part III, Supplementary Functions and Cases, the supplementary but equally important functions are analyzed.

Transformer Know-How

MANUAL OF INSTRUMENT TRANSFORMERS. GET-97A. Size 8½ by 11 in.; 73 pp; illustrated; spiral bound. Available from Apparatus Department, General Electric Co., Schenectady 5, New York. Price $1.00.

THIS MANUAL should prove helpful to practicing engineers engaged in the fields of power generation, transmission, and application, faced with countless metering and relaying problems that can be solved only by the correct application of instrument transformers.

The manual is written with the intention of helping the reader apply standard transformers to his own needs rather than of making him an accomplished designer of instrument transformers.

It covers the basic fundamentals of instrument transformers, such as accuracy standards, insulation and polarity. In addition, it gives complete information on potential and current transformers, including operating principles, types and ratings, applications, circuits and fusing.

A chart for selecting the proper transformers for a specific application and a bibliography covering various phases of instrument transformer operation, design, application and performance are also included.

Warm Air — Cold Air

MODERN AIR CONDITIONING, HEATING AND VENTILATING by W. H. Carrier, R. E. Cherne and W. A. Grant. Second edition. Size 7 by 10 in.; 574 pp including index and appendix; illustrated; cloth bound. Published by Pitman Publishing Corp., New York, N. Y. Price $10.00.

THIS SECOND edition incorporates a thoroughgoing revision of many sections in which progress in the field of air-conditioning, heating and ventilating has made notable strides in the past ten years.

Important new tables of basic factors have been added; a section on oil-burner application; engineering data on panel heating; new techniques in air cleaning and purification; basic data for cooling coils; functional analysis of central conditioning systems; and new fundamental treatment of automatic control.

Other outstanding additions to this new edition are the latest psychometric chart based on enthalpy; new material on axial flow fans; and fundamental information on cooling and dehumidification, including heat transmission formulas.

Practicing engineers of heating, ventilating and air-conditioning will find this book helpful.

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With its renewable disc and seat, non-wearing conical spring, the Williams-Hager Valve offers dependable protection in any position—horizontal, vertical with flow upward, vertical with flow downward and angular. Easily installed or reseated without special tools, it is available in standard pipe sizes from 1" to 20".

Write for Bulletin WH 100

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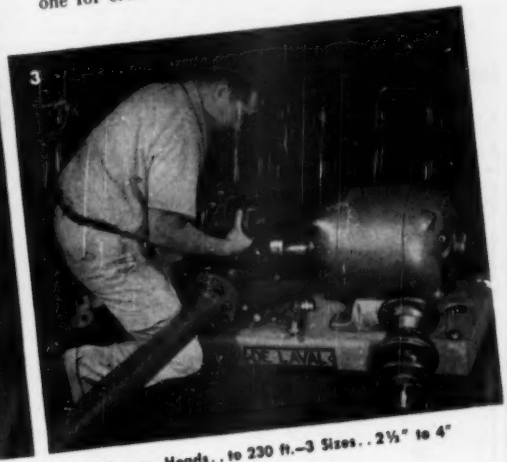
IT'S SERVICE THAT COUNTS!

That's why we designed our new GS pump so that every working part . . . every part subject to wear . . . is contained in one easily replaced rotor assembly. Through our *Service and Exchange Plan*, new rotor assemblies are available for immediate shipment from conveniently located stocks throughout the country.

Then, when maintenance does become necessary here's all you have to do:

1. Remove the cover and the end plate studs.
2. Lift out the old rotor.
3. Drop a new one in place and return the old one for credit on serviceable parts.



Capacities . . to 400 gpm – Heads . . to 230 ft.–3 Sizes . . 2½" to 4"

DE LAVAL STEAM TURBINE CO. *Trenton 2, N. J.*

GP-23

DE LAVAL STEAM TURBINE CO.
Trenton 2, New Jersey

Please send me a copy of your new GS Pump Bulletin.

Name_____

Company_____

Street_____

City_____ State_____

1001-23PE

LIKE AN
ATOM-IC
EXPLOSION

Just ONE 1/32" pin-hole size faucet LEAK
MUSHROOMS into ATOMIC WASTE
of approximately 76,800 gallons
of water yearly—COSTING:
$10.13
@ $1 per M cubic foot

If a hot water faucet, then actual FUEL WASTED heating 76,000 gallons costs approximately:

$27.65 if coal (7,900 lbs.)
$38.00 if oil (633 gals.)
$30.63 if gas (67,500 cu. ft.)

STOP this needless WASTE during today's MATERIAL and MANPOWER shortages with 'SEXAUER' "Easy-Tite" that outwear ordinary faucet washers 6-to-1, thus SAVING labor on 5 REPEAT repairs, PLUS water and fuel, while prolonging the life of SCARCE fixtures.

PAT'D.
"EASY-TITE"
FAUCET WASHERS

...a modern laboratory triumph, are compounded from du PONT NEOPRENE instead of rubber—to withstand DESTRUCTIVE HEAT common in present-day super-heating water systems—that formerly broke down washer's structure (tested to withstand 300°F.)

Built like a tire with fabric re-inforcement they resist the grinding, closing squeeze that SPLIT and MUSH ordinary washers out of shape... causing LEAKS.

Through combining NEOPRENE and FABRIC RE-INFORCEMENT they OUTWEAR ordinary washers 6-to-1 on hot or cold TAPS—thus you slash water fuel and labor costs.

THE NEW 'SEXAUER' CATALOG

Edition F, just out pictures over 2500 TRIPLE-WEAR plumbing REPAIR parts and Pat'd. Precision Tools. It's today's accepted buying guide for discriminating purchasing and maintenance personnel among thousands of top PLANTS, INSTITUTIONS and GOVT AGENCIES that rely on SEXAUER repair materials. Send for your copy today!

Then too, there's a SEXAUER TECHNICIAN within quick call from coast-to-coast, who offers a special SURVEY service that sets up a schedule of the exact replacement parts required for your particular plumbing fixture regardless of make or age and *without obligation.*

A postcard will bring him and your NEW Catalog F promptly.

J. A. SEXAUER MFG. CO., INC., Dept. 8128
2501-05 Third Avenue, New York 51

SEXAUER
WORLD'S LEADING SPECIALISTS IN PLUMBING AND HEATING REPAIR PARTS

as advertised in THE SATURDAY EVENING POST

Plant Protection

(Continued from page 37)

who may have ulterior motives to destroy it.
I will report any suspicious acts to my foreman, supervisor, or department head.
I will protect all the tools that are part of my job or craft.
I will do everything in my power to co-operate in the campaign against the spy and saboteur.

A copy of this creed should be given to every employee. Every employee should be impressed with the fact that, in reporting any act that he suspects may be committed against the defense program or war effort, he not only protects his own job, but he takes steps that may protect his own life.

Space will not permit me to cover all the categories embodied in the Plant Protection Guide, such as employee identification; loyalty checks; fingerprinting of employees and applicants; proper evaluation and dissemination of information; checking of gossip and unfounded rumors; and extra precautions against hiring aliens and others readily accessible to foreign agencies. Then come the details of plant protection areas, such as adequate fencing, lighting, screening and floodlighting and other measures of equal importance.

Also that safety measures are essential to any plant and extra precautions should be taken to prevent fires, protect property, and reduce hazards.

As shown by the hypothetical bombing of Chicago, we need to face one startling fact: *We are vulnerable to attack.*

Convinced that plant protection should be considered *preventive* action, because it covers police action, we recommend that plant protection and security matters be placed on a *voluntary* basis. We do not recommend compulsory methods. Success of such a voluntary program can be brougth about through salesmanship, contacts, and liaison. One cannot legislate that a man protect his life or his property. But education and co-operative effort may accomplish that very goal.

Our main objective is to protect life and property against enemy attack or war production facilities and, if disrupted, to restore them speedily to normal or near-normal operations.

We must always remember the fact that terrorists, trained in the tactics of sabotage and espionage, are among us. They must never be given a chance to turn a valve, press a buzzer, or drop a bomb. Their efforts to destroy, to stop the flow of material on the supply line, must be thwarted in the *planning* stage.

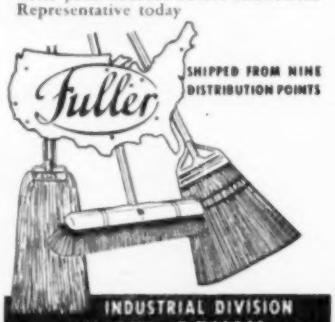
The enemy's strategy to divide and conquer must never proceed beyond his blueprint. *We must be prepared.*

Complacency might result in our

Down Go Cleaning Costs

With Wear-Resistant FULLER FIBER BROOMS

You can reduce your daily cleaning costs with Fuller Fiber Brooms. Grueling wear-down tests by our own Research Department and, more important, the tests performed by our thousands of satisfied customers, prove conclusively that Fuller Fiber Brooms give better service for a longer period of time. We invite comparisons of the wearing qualities of the Fuller Fiber Broom with any other broom under any sweeping conditions. Test it yourself. Phone or write your nearest Fuller Industrial Representative today



SHIPPED FROM NINE DISTRIBUTION POINTS

INDUSTRIAL DIVISION
The FULLER BRUSH Co.
3637 MAIN STREET • HARTFORD 2, CONN.
In Canada: Fuller Brush Co., Ltd., Hamilton, Ont.

HOW SUPERIOR'S 4-pass design gives you . . .

Taper Tube EFFICIENCY

The long-lived efficiency of Superior Steam Generators results from fundamentals of design which are basically sound. Superior's 4-pass, down-draft design provides a minimum of 5 sq. ft. of heating surface for each unit of horsepower rating; **and every inch of that heating surface is effective.**

WHY 4-PASS?

Theoretically (from the standpoint of heat transfer alone) the fire passes of a perfectly designed fire tube boiler would resemble a long, very gradually tapered cone surrounded by water. The large end would be sized in ratio to the volume and speed of the combustion gases so that the gases would be crowded into the tube and thus "scrub" the walls of the tube, forcing contact between fire and tube surface. As the gases give up their heat to the surrounding water (by transfer through the tube) the gases shrink in volume. The gradual taper of the tube compensates for this shrinkage, maintaining the scrubbing action which promotes efficient heat transfer.

Such a fire tube is impractical; but Superior's 4-pass design achieves the same effect. Its 4 passes are so designed that each successive pass has a lesser number of tubes (and hence a smaller area in cross section) for the passage of combustion gases. This is, in effect, **taper-tube** performance which results in the maximum practical efficiency of heat transfer . . . performance which makes it possible for Superior to guarantee **more** than 80% thermal efficiency **under field operating conditions.**

Superior Steam Generators are completely factory assembled, backed by undivided responsibility. Burn gas or oil, or both. Manufactured in 18 sizes from 20 to 600 b.h.p. for pressures up 250 p.s.i. or for hot water.

Write today for the details in Catalog 205.

uperior ombustion ndustries, inc.

Factory Emmaus, Pa.
Executive Offices Times Tower, Times Square, New York 18, N. Y.

DUST
HERE'S SAFETY IN NUMBERS!
5
SIZES OF HOFFCO-VAC Portable VACUUM CLEANERS and
STATIONARY SYSTEMS IN SIZES FROM 3 to 100 H.P.

For your campaign against dust that is hazardous to health or damages production, Hoffman offers a broad selection of vacuum cleaning equipment with a type and size exactly right for your cleaning problem. Heavy-duty portables in 1½, 3, 5 and 7½ horsepower models, plus a 5 H.P. model powered by gasoline engine. For these, or the wide range of stationary systems, your Hoffman representative can furnish exact recommendations.

NEW! 1½ H.P. HOFFCO-VAC operates 35-ft. Length of Hose

Industry's first BIG little vacuum cleaner! Built for heavy-duty, continuous service. *Big* in dust storage capacity, suction and dust separation, yet compact, portable and easy to operate.

WRITE FOR BULLETINS!

HOFFMAN BUILDS
Multistage Centrifugal Blowers and Exhausters

U. S. HOFFMAN
MACHINERY CORPORATION
AIR APPLIANCE DIVISION
111 FOURTH AVE., NEW YORK 3, N.Y.
CANADIAN PLANT: NEWMARKET, ONT.

being too late with too little in the defense of our civilian population and supply lines. It might mean the end of civilization as we know it today. Therefore, we must make comprehensive plans for a *long-range program* for protection and security NOW. Let us provide ourselves at least with a velvet curtain to protect us from those behind the iron curtain.

Evaluating Crane Proposals

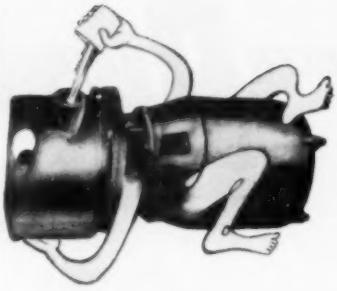
(Continued from page 61)

A, although he has thinner web plates, has provided sufficient depth to the girder and although bidder B may have just as strong a girder because of the 5/16-in. thickness of web plates, he has provided more dead weight in the girder than is necessary.

Under Item 6, we find that bidder A has provided four 24-in. truck wheels against bidder B's four 21-in. truck wheels. Here we must rely upon the data given above, which indicate that a 24-in. truck wheel will have more service life and greater bearing life hours built into its corresponding drive parts than the 21-in. wheels and drive parts of bidder B. The only definite way of making a verification of these facts would be requiring the crane builder to submit the bearing life hours, either given in average bearing life hours or in the B-10 rating, which now is being widely adopted. This would give definite proof of the bridge truck bearing life expectancy.

Item 7 has a very important factor on the bearing life hours of the truck wheels, and we find that bidder A has shown a maximum wheel load of 50,600 lb. against bidder B's 44,000 lb. Now, maximum wheel load means just what it says. It means that the crane trolley will be at its closest approach toward the crane runway and have a 20-ton load suspended from its hook. Under normal conditions, the cage corner or the corner of the crane where the cage is suspended will have the maximum wheel load.

On this corner is concentrated the weight of the cage with its control apparatus in addition to the weight of the trolley and its load. If the crane has full magnetic control mounted on the platform, this also must be included in the wheel reaction at the cage corner, since the concentrated weight of full magnetic control mounted on the platform will materially affect the maximum wheel load. Since some variation of wheel loads and their method of calculations are apparent from various crane builders, it is well for a buyer to use the heaviest wheel load specified in order to be on the safe side. Keep in mind that a crane is no better than the runway that supports it, and if the crane runway is designed on the basis of a low wheel load, a light runway section definitely will be detrimental to



IN SELF-PRIMING
Pumps
ONLY THE NEW
Goulds
GIVES ALL FIVE
IMPORTANT ADVANTAGES

Fig. 3639-3678 Self-priming centrifugal (Patents Pending)

1. **Absolutely no valves of any kind in pump**—nor are any needed in installation.
2. **No recirculation of liquid** after completion of priming action.
3. **Efficiencies** comparable to quality straight centrifugal pumps.
4. **Positive fast-acting self-priming** like priming ability of positive displacement pumps.
5. **No large or bulky priming chambers or reservoirs**—a compact unit at low cost.

SIZES AND CAPACITIES

39 models and sizes, ¼ to 5 H.P. ratings. Capacities to 120 G.P.M. Heads to 135 ft. depending on capacities. Suction lifts to 25 ft. Open and closed impellers. Flexible coupling or Close-coupld motor drive.

WRITE for full details—Bulletin 636.1

Goulds PUMPS INC.
Seneca Falls
New York

Copper Tube Pipelines

offer these three basic advantages

1. **FLEXIBILITY,** in installation and in operation. Bends and offsets to clear beams and girders are readily made in copper tubes; soldered connections can be made in spaces too restricted to manipulate a wrench. Once installed, copper tubes connected with solder fittings can be taken down, moved, or have new connections cut in faster and with less expense than with threaded pipe.

2. **MODERATE COST,** for material and for labor. Solder-type fittings eliminate threading, reduce tube weight, require minimum time for layout and installation.

3. **SUPERIOR PERFORMANCE.** Solder fittings give uniformity of bore to copper tube piping; flow is unimpeded at joints, and the rust-free surface of copper means a low coefficient of friction, with reduced pumping costs. The corrosion resistance of copper provides assurance against premature pipe replacement and excessive maintenance cost.

ANACONDA

Anaconda

COPPER TUBES

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 20, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

ANACONDA Copper Tubes in standard sizes are manufactured to A.S.T.M. and Federal Specifications. Types K and L are furnished soft in long coils; also hard and soft in 20-ft. lengths from ⅜" to 12" in diameter. Type M tube is furnished hard only in 20-ft. lengths from 1¼" to 12" in diameter for waste, drainage and vent lines. Larger sizes, up to 26" I.D., can be made to order.

Write for Publication C-24 on ANACONDA Copper Tubes and Fittings.

4580 Rev.

U. S. Pat. 2,181,076

SPEER carbon brushes, with their freedom from sparking, overheating, and energy loss, are widely used in the electric motors that gather and pump oil. The high current-carrying capacities and excellent contact provided by Speer brushes make them equally valuable in motors for *any* pumping job.

A complete line of brushes has been developed by Speer to match every mechanical and electrical service characteristic. All have been rigidly tested under actual service conditions. For smooth, trouble-free commutation . . . for peak motor performance . . . fit your motors with Speer carbon brushes.

Speer
CARBON COMPANY
ST. MARYS, PENNA.

brushes · contacts · welding electrodes · graphite anodes · rheostat discs · packing rings · carbon parts

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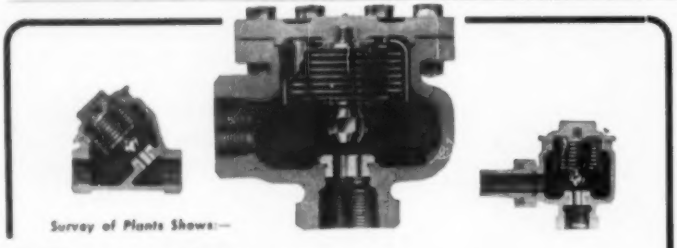


Survey of Plants Shows:—

15 of 20 Engineers Prefer Nicholson Traps

To determine the best steam trap on which to standardize, a large processing firm recently asked their plant engineers for their preference. In 15 out of 20 plants the choice was Nicholson.

The repeated adoption of Nicholson steam traps in plants currently in big "cost-reduction-through-modernization" programs is another indication of their advanced features. To learn why an increasing number of leading plants are standardizing on Nicholson thermostatic steam traps send for our catalog. 5 types for every power, heat, process use; size ¼" to 2"; press. to 225 lbs.

Catalog 250 or see Sweet's

W. H. NICHOLSON & CO. 208 OREGON STREET WILKES - BARRE, PA.

keeping the runway in good alignment. A runway that does not keep in good alignment will be the cause of constant maintenance to the crane itself.

Under Item 8 of the bridge, we note that the wheel base specified by bidder A is 13 ft 8 in. and that specified by bidder B is 12 ft 3 in. Here again we can use a rule of thumb that the ratio of span to wheel base shall be a minimum of 1 to 7. The 90-ft span divided by 7 gives us an approximate minimum wheel base of 12 ft 9 in., and therefore bidder A has exceeded this minimum requirement and bidder B is somewhat under the minimum requirement. The reason for this rule of thumb is to provide squaring action for the crane itself. If the wheel base is too short for the span, the squaring action of the crane and its ability to run straight down the runway will be impaired greatly.

Snow Fences

(Continued from page 50)

sive slant. With proper slope and placement, and with a prevailing wind, this type of fence will pile snow twice the height of the fence.

As an indication of the importance of the snow problem on highways, the State of Pennsylvania will this year use 13,000,000 ft in areas subjected to high winds and drifting snow. In addition, 600,000 t of cinders and abrasives will be stockpiled, and about 2400 snow plows on trucks, tractors and power graders will be used to clear the highways. The State clears about 20,000 mi of primary and 29,000 mi of secondary roads.

For effective service snow fences must be placed properly in order to take advantage of the terrain. The local road crew is a good source of experienced information. They are concerned only with public roads, yet in many cases they must depend upon private property owners to place the snow fences properly. It is a reciprocal consideration. Also, these men know more about this problem than anyone else from the standpoint of practical consideration in a particular area.

Remember, the function of the snow fence is to cause drift formation in the lee of the fence and also utilize the down slope of the drift to augment the wind to give a sweeping action in the area to be kept clear.

As a rule a single fence properly placed will be effective. Sometimes a double row fence with the second spaced 100 ft back from the first is necessary. In wide open fields a low 2 ft board fence snow irrigation can be used to advantage.

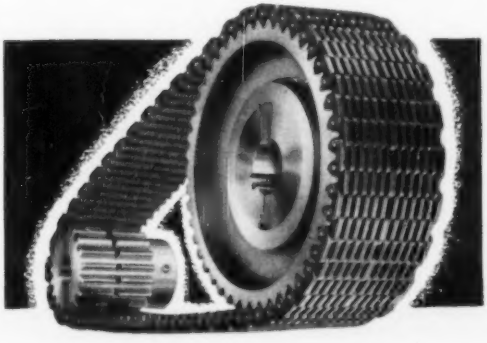
ALWAYS A GOOD FIRST STEP

to Sound Power Transmission . . . WHITNEY CHAIN DRIVES AND FIELD SERVICE

As a builder or user of machinery, you can take a long step towards reducing your power transmission costs by standardizing on Whitney Silent Chain Drives.

That's been the experience of many leading machinery designers and manufacturers. And they've learned that these outstanding drives contribute to product reputation through real service performance.

Here's why . . . deeply seated in sprocket teeth Whitney Chains transmit full-rated horsepower without friction or slippage. This gives you constant machine output . . . highest transmission efficiency. Their versatility and adaptability simplifies design. They operate on short or long centers, drive shafts clockwise or counter-clockwise, separately or simultaneously. In addition, Whitney's 50 years of specializing in the building of quality chain drives, guarantees the utmost in drive life with minimum maintenance.



PLUS WHITNEY SERVICE—And remember, Whitney Chain Drives . . . roller, silent, conveying chains, and cut-tooth sprockets . . . are carried in stock by a nation-wide network of more than 130 Whitney distributors. This fast local service saves you time, assures prompt delivery of your chain drive requirements . . . means that you are served more readily. In addition, 15 Whitney field offices, strategically located throughout the country, are at your service to help you solve your power transmission problems. For specialized chain engineering assistance consult your nearest Whitney field offices or write for catalog:

WHITNEY *Chain Drives*

WHITNEY CHAIN COMPANY

232 HAMILTON STREET, HARTFORD 2, CONNECTICUT

IF AIR-MOVEMENT CAN DO THE JOB...

Hartzell can move the air!

1,250,000

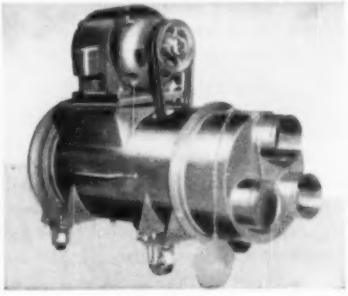
CUBIC FEET PER MINUTE

At the left is shown a 22-foot Hartzell fan on a test stand. It isn't a special job. It's a cooling tower fan so good, so powerful, so trustworthy, that it's the standard for an industry where huge-volume air-movement is a distinct advantage. Hartzell builds it. Available in 3' to 22' diameters.

Hartzell ventilation systems are efficiently handling factory ventilation problems everywhere. Operating costs are low, and Hartzell systems remain trouble-free year after year. Ventilation, to Hartzell, includes dissipation of heat, fume and dust concentrations, as well as duct and ductless air-change systems. But Hartzell does many things, where air is concerned, in addition to ventilation. If you need air-movement for any purpose, get Hartzell engineering on the job.

SPECIAL HARTZELL APPLICATIONS FOR SPECIAL PURPOSES

Shown at the right is a Hartzell Vaneaxial Blower "with casters." Easily lifted by two men; compact; powerful. Specially mounted by Hartzell to clear fumes from gasoline tank trucks before and during interior welding repairs. An example of Hartzell ability to meet special needs. If you have a product utilizing air-movement, or a special need, get in touch with us. We'll work with your engineers to give you what you want.



There is a Hartzell field representative near you. If you don't know him, drop us a line; we'll send information or he'll be there promptly, as you wish.

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PROPELLER FAN CO.

DIV. OF CASTLE HILLS CORP.

PIQUA, Dept. C OHIO

PROPELLER-TYPE FANS AND BLOWERS—ROOF VENTILATORS—UNIT HEATERS • ENGINEERING OFFICES IN PRINCIPAL CITIES

(Continued from page 20)

heavy-duty features of the larger industrial machines are provided in Illustrated Bulletin A-814. The cleaner is a 1½ hp machine which operates a 35-ft cleaning hose, and has a dust container big enough for continuous service, dust separator with four inverted type filter bags, and a quick-acting lever release on the container. Air Appliance Div., United States Hoffman Machinery Corp.

140 Modern Plant Maintenance— You'll find a good many of your plant's maintenance needs described and illustrated in this handy 50-pp catalog. Covers cleaners and dressings for practically all types of floors, wood sealers, roof coatings, antiseptic soaps and deodorants, insecticides, as well as scrubbing and polishing machines and other maintenance equipment. Includes post cards for requesting booklets on maintenance programs, floor treatments. Hillyard Chemical Co.

142 Versatile Floor Machine—Form 340 describes and illustrates a machine for practically all floor maintenance jobs from scrubbing and polishing to sanding. Gives sizes, specifications and pictures interchangeable attachments. Clarke Sanding Machine Co.

143 Power Brushes—Bulletin C-340, describing company's new line of power brushes, contains many photos showing their design and use. Complete ordering instructions and specifications are included. Inserted in the folder is an application data sheet on which to submit your plant's cleaning, scrubbing or finishing problems. The Osborn Mfg. Co.

PUMPS

144 General Service Pumps—The pumps described in Bulletin 48-38-3000, 12 pp, are moderately priced, horizontal, single-stage end suction centrifugal pumps for general industrial service. Includes full specifications and dimensional data for both standard construction pumps and pumps designed for handling gasoline, butane, diesel fuel and similar inflammable hydrocarbons. Byron Jackson Co.

145 Pumps for Processing—Manual 2300 covers pumps for handling corrosive and non-corrosive liquids, solids-carrying liquids and dry and semi-dry materials. For easy reference, this 12-pp, well illustrated catalog is arranged according to intended service, the section on liquids emphasizing vertical submerged centrifugal pumps and horizontal end-suction circulating pumps. Non-clog centrifugal to handle solids-carrying liquids, and company's Shone pneumatic unit, its application, operation and advantages, are described in the second section. The final section presents company's Transporter for bulky, dry and semi-dry materials. Yeomans Brothers Co.

TOOLS

148 Catalog on Portable Tools—Over 125 electric and pneumatic tools for the manufacturing and construction service industries are completely illustrated and described in 72-pp Catalog 50. Arranged for easy reference, it includes specifications and features, applications and uses of company's full line of drills, sanders and other portable power tools. Skilsaw, Inc.

149 For Smooth Sanding—This 32-pp booklet serves as both ordering catalog for sanders and manual for their use. Describes and illustrates four models, providing straight line and orbital sanding action. Gives full specifications, operating instructions, available accessories and parts list. Prices included, also photos of sanders. National Air Sander, Inc.

150 Modern Soldering Guns — Up-to-the minute soldering information helpful to plant electricians, mechanics and laboratory workers, is packed into single-sheet Form 6200A. Fully illustrated, it covers guns for practically all soldering requirements and features a new light-duty model with dual spotlights — twin prefocused lights to eliminate shadows in the working area. Includes detailed descriptions, prices. Weller Electric Corp.

151 For Grinding and Lapping — Form 278 describes precision tool-grinding and lapping machines made in Switzerland but available here. Photos show how these machines are built to reduce grinding time and wheel wear. Specifications included, also tips on wheel selection. Agathon Div., Hauser Machine Tool Corp.

152 Portable Hack Saw — **The Hand-I-Hack**, a power hand saw light enough to carry with one hand, which operates from any outlet, is described in this well illustrated folder. Pictures the saw at work and tells some of the many metal cutting jobs it is built to do. Includes specifications. Lipe-Rollway Corp.

LUBRICATION

153 Centralized Mass Lubrication — How to save on man hours, machine hours, materials and power by means of standardized, mass lubrication systems is explained in Form 1-2470, 8 pp. Shows how these systems are being used in metal, textile, food processing, mining and construction industries. Describes and illustrates automatic, semi-automatic and manually controlled systems. Also illustrates special fittings. Lincoln Engineering Co.

154 Test Data on High Temperature Oils — The results of an extensive research program on high temperature lubrication are told in Bulletin 2-416. This well illustrated folder completely describes the testing procedures used in setting up three series of oils to meet high temperature conditions up to and even over 500 F. These include straight mineral oils, semi-synthetic lubes, and colloidal graphite in light carrying oil. E. F. Houghton & Co.

REFRACTORIES

155 Refractory Hung Arch — Bulletin 950 explains how company's refractory hung arch not only hangs — but moves — like a pendulum. It describes the ease of installation and positive locking arrangement between lower and upper tiles to prevent disengagement in service. Illustrates rugged load tests given this double hung arch on both its load bearing qualities and strength of interlock. Geo. P. Reintjes Co.

156 Super Refractory Coating — This folder describes a ceramic refractory coating with many advantages for use in new refractory construction and as a maintenance coating. Includes test data, application and ordering information. Cera-Kote, Inc.

SAFETY, SANITATION

157 Up-to-Date Plant Sanitation — "New Ideas on Plant Sanitation and Maintenance," a 16-pp booklet, is a reprint of a paper by J. Lloyd Barron, Sanitary Engineer of National Biscuit Co., which includes answers to often-asked questions on this subject. Discusses scope of plant sanitation, responsibilities involved, floor maintenance, toilet and locker rooms, pest control, waste disposal. G. & T. Tennant Co.

158 For Safety Undertoot — Contending that floor safety is a matter of individual plant conditions, this folder describes 20 of company's floor products — polishes, powders, sealers — developed for use on various types of industrial floors. Tells how each is applied and where it should be used. Walter G. Legge Co., Inc.

159 So Those Who Must May Talk — Illustrated Bulletin B-21 announces a voice-powered wire communication system for long or short distances for use by those whose work in toxic atmospheres requires wearing of gas masks. Contains photos of full assembly, handset, head harness. Also pictures use with company's respiratory protective equipment incorporating speaking diaphragm. Mine Safety Appliances Co.

METALS, METAL WORKING

160 Chart on Metals for Corrosive Services — Name your poison, corrosive that is, and you'll find it among the 350 listed in this selection chart. List includes corrosive media common to a wide range of industrial jobs and covers their use with carbon steel, three of company's alloys and certain other alloys, showing whether each metal is recommended, suitable or unsuitable for use. Since metals are arranged in order of cost it's also easy to select the one that handles your particular corrosive most economically. The Cooper Alloy Foundry Co.

161 Lead in Modern Plumbing — Why, where and how lead is used in modern plumbing is told in this 24-pp book. Various sections treat lead service pipe for water distribution, lead for interior plumbing, use of calking lead, lead shower pans and lead for vent stack flashings. A brief history of lead pipe for plumbing is included. Book tells how lead pipe and fittings are made and includes, in tabular form, Federal specifications for lead pipe, traps and bends and commercial standard for calking lead. Profusely illustrated, it provides drawings of suggested roughing-in for plumbing systems and tips on correct installation methods. Lead Industries Association.

162 If Wire Has You Snarled — This 4-pp booklet, so titled, may show you how wires of nickel and the nickel alloys can solve your problem. It discusses their resistance to high temperature and corrosion, their electrical and mechanical properties. Also describes and pictures some of the special jobs these wires are doing. Includes a sample coil of Monel wire. The International Nickel Co., Inc.

December, 1950

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PLANT ENGINEERING

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163 Handbook on Hardfacing Alloys — Twenty-pp illustrated Catalog 11 contains detailed information on company's line of hardfacing alloys. Description of product, typical uses, mechanical properties, chemical analyses and a brief outline of recommended procedures are included. Data are supplemented by a tabulation of recommended grinding wheels for dressing deposits of certain hardfacing alloys. Air Reduction Sales Co., Air Reduction Co., Inc.

164 Blast Cleaning in Metal Working — How blast cleaning solves acid pickling problems is explained in illustrated Bulletin 3044. Tells how this airless blasting process has influenced cleaning speeds, costs and safety in the metal working industry. Presents three actual case histories covering applications involving cleaning of drop forgings, forged automobile parts and steel strip. American Wheelabrator & Equipment Corp.

BOILERS, GENERATORS AND ACCESSORIES

165 Boiler Feed Pump Systems — Cost cutting and production increasing advantages of company's boiler feed pump systems designed to save condensate are outlined in Bulletin AP-41. Gives general specifications, description of equipment furnished. The C. H. Dutton Co.

166 Job Studies on Steam Generators — Actual case histories covering installations of company's packaged steam generators in a dairy, a dry cleaning establishment and the animal houses of a city zoo, are presented in three illustrated folders. Other data given include figures showing annual savings afforded by burning low cost oil and basic design advantages. Shipley Cooling & Heating Div., York-Shipley, Inc.

167 Tube Expanders — In Bulletin 304-C are described and illustrated a variety of tube expanders for use in the installation and maintenance of tubes in fire tube boilers, water tube boilers, condensers, heaters. Includes application information, sizes, prices. The Gustav Wiedeke Co.

168 Tube Rolling Control — A precision method of uniformly expanding condenser and heat transfer tubes is presented in this 8-pp bulletin. Describes and illustrates the control unit and three driving motors, giving operating instructions for both. Crane Packing Co.

169 Boiler Seam Saver — Described in this circular is a refractory tile attachable in sets by bolts and hangers to the seams of riveted HRT boilers to insulate the lapped edges from fire-cracking and oxidation. Illustrations show how protector is used, test stresses its efficiency and safety advantages. Sizes, directions for use in special conditions included. National Boiler Protector Co.

PACKINGS

170 Teflon Packings — Form AD148 offers 4-pp of product information on packings and gasketing material made of Teflon, giving their properties, typical and special applications. Available styles and types are pictured, their construction described and sizes given. Includes chapter on the toxicology of Teflon at extremely high temperatures and precautions to be observed. The Garlock Packing Co.

171 Long Wearing Piston Packing — Form 4502, 8-pp, stresses use of company's composition cups for packing the pistons of air and hydraulic cylinders and reciprocating pumps. Engineering information included covers properties, textures available, temperature and pressure data, and sizes. Many types of machines on which these cups are used are pictured. Darling Valve & Mfg. Co.

172 Buyers' Guide on Packings—Twenty-pp Catalog PC-121 brings together all material on company's Palmetto packings previously available only in product bulletin sheets, and includes data on a new packing for liquid pistons on inside-packed piston pumps. Self-lubricating, molded and special packings are covered in detailed text and there's a full explanation on performance of the self-lubricating type. Photos, application charts are provided, also complete ordering information. Greene, Tweed & Co.

OTHER EQUIPMENT

173 Services for Your Plant — Bulletin L.19.57 is a 16-pp illustrated booklet covering company's five divisions and their scope: chemical, petroleum, natural gas, power and equipment. Tells firm's work in the fields of design, engineering, construction, process coordination and equipment manufacturing and includes photos of typical projects, plants and equipment installations. J. F. Pritchard & Co.

174 Fundamentals of Hydraulics — Technical Bulletin E-4 is a newly revised 44-pp guidebook covering essential information on hydraulic systems, maintenance, trouble-shooting and selection of proper fluids. Besides offering well-organized reference data for plant engineers, this book is suggested as a training manual for maintenance personnel. It features phantom and cutaway drawings illustrating functions of basic types of valves, pumps, hydraulic motors, torque converters and a unique system of captioning shows the function of each component part. Please give your title when requesting this book; extra copies are available for your staff if you ask for them. Sun Oil Co.

175 Small Area Heaters — Form 1960 describes and illustrates construction details of heaters specially designed for use in small buildings, warehouses, power plants and locomotive cabs, for use with steam or hot water, even waste heat from engine jacket water. Capacities, dimensions included. Young Radiator Co.

176 Pressure Blower — Described as a new concept in air-moving equipment is the direct drive axial flow pressure blower featured in this 24-pp collection of engineering data sheets. This blower which has its motor in the hub is for volumes to 100,000 cfm and pressures to 4 in. wg. Discusses general construction features of the blowers and covers standard, enclosed, and reverse direct-drive units, also belt-drive units. Fully illustrated, includes dimensional and installation tips. The Moore Co.

177 Small Cooling Towers — Illustrated Bulletin 44 announces a line of atmospheric spray cooling towers for small water cooled air conditioning and refrigeration condensing units. Engineering data included cover tower specifications, tables of dimensions and weights, selection tables, and tables showing pressure drops of water in pipes of various diameters and pressure losses due to pipe fittings. Binks Mfg. Co.

178 Pneumatic Sewage Ejector — Illustrated Bulletin S-59 describes a pneumatic or compressed air ejector developed to overcome and eliminate clogging of screens and pumps, and discusses the ejector's advantages in terms of efficiency, economy and better sanitation. Operating principle is explained and illustrated by piping diagrams showing snap action air valve, electrode controls and float switch. Capacities, dimensions included. The Blackburn-Smith Mfg. Co., Inc., Condenser Service and Engineering Co., Inc.

179 For Soda Ash Recovery — The recovery of soda ash or salt cake from boiler gas in the pulp industry sulfate process by means of black liquor type electrostatic precipitating equipment is described and illustrated in this bulletin. Explains operation of equipment, illustrates an installation. Koppers-Elex Precipitator Dept., Koppers Co., Inc.

180 Water Filtering Equipment — This folder describes a centrifugal filter water rectifier. Illustrated with photos and sketches, it explains how the rectifier works, describes the de-scaler galvanic cell incorporated. Briefly tells what the filter and rectifier do, lists features, gives capacity data. Butler Engineering Co.

181 Visible Record Control — Plant engineers interested in efficient maintenance of their business records can get some helpful tips from 36-pp Catalog KD 462, a recently revised and comprehensive presentation of company's Kardex visible control principle. Describes various combinations of record forms which can be used in Kardex pockets and variety of signal control methods possible. New computing charts which eliminate a lot of calculating are pictured. Also shown are cabinets, including a new mechanized unit, and equipment for protecting vital records from fire. Remington Rand Inc.

182 Static Elimination in Textile Mills—Bulletin 78 describes briefly and pictures static eliminating equipment for wool and worsted carding, felt and batt making, cloth finishing, also drawing, slashing and warping. Lists several hundred mills where this equipment is in use. Chapman Electric Neutralizer Co.

183 Ash Handling Systems—This 24-pp illustrated booklet offers technical information on hydraulic and pneumatic ash and flyash handling systems. Compiled in question and answer form, it discusses elements and advantages of various systems and disposal schemes. Schematic drawings of arrangements under specific conditions and diagrams of basic arrangements are included. Beaumont Birch Co.

184 Improved Machine Mountings — Catalog Section 7290 features a step-by-step description of installation methods on company's Vibropad rubber mounting, a rubber pad 12 in. sq., with rubber tubes and snubbers from which individual machine mountings may be fashioned. Folder pictures all parts and includes cutaway sketches of installations on vertical and inclined machines. Photos of typical machines on which these mountings are used are included. The B. F. Goodrich Co.

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3. **Automatic adjustment for body distortion.** Diagonal face of upper wedge is curved and lower wedge face is straight; both faces are transversely beveled, to equalize wedging pressure against discs and permit tight 360° seating despite any misalignment of seats.
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5. **Advanced metallurgy.** Unusually rigid control and advanced methods provide castings that are superior to ordinary castings in strength, density, pressure-resisting characteristics, and in resistance to abrasion and corrosion.

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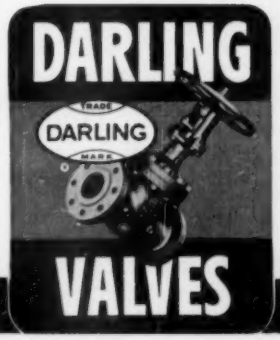

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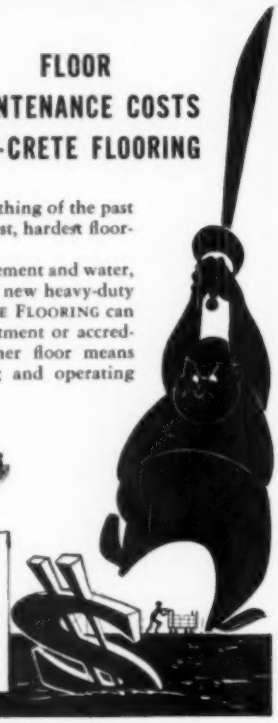

Lubrication Surveys

(Continued from page 40)

a system of tagging or decal application to their machines will assist them in getting the right oil to the right reservoir, the plant engineer should assist them in coding their machinery in this way. Frankly, although such coding systems have potential merit, many have not generally proved satisfactory, usually because of insufficient follow-up.

Let's assume that the paper work and instruction of the oiling staff has been completed, the number of brands has been materially reduced, and that the standard oils selected for plant-wide use represent good quality products at reasonable prices.

Additional economy may be effected through reclaiming oils by simple filters or more elaborate reclaiming equipment. Any appreciable volume of a particular oil type consumed should be carefully studied for possible reuse after reclaiming. Thus, hydraulic oils may be reclaimed in many instances, particularly where contamination is principally dirt and water of condensation. If the circulating hydraulic system does not expose the oil to extremely high temperatures, the plant engineer should be able to obtain additional use from the oil. If the oil is not suitable for use again in the same hydraulic system, it may well be used for hand-oiling in all-loss systems thus saving substantially on purchases for that application.

Additional economy may be effected by arranging for tank truck (approximately 4,500 gal) delivery of lubricating oils which should reduce cost approximately 4 cents per gallon. An even greater economy can be obtained, where the volume warrants, by purchasing in railway tank cars of approximately 6,000 gal. The cars may be ordered compartmented in three divisions allowing the purchase of three different oils on one shipment. Price reductions of about 25 per cent should be available through such bulk purchasing.

The satisfactory completion of the work outlined above should have achieved the following benefits: (1)—Simplified and recorded oiling practice, thus insuring proper lubricant application and facilitating training of oiling personnel; (2)—Full compliance with machinery manufacturers' lubricant recommendations, thus preventing the accidental voiding of equipment guarantees through improper lubricant use; (3)—Simplified purchasing, ordering, dispensing, and inventory due to reduction in the number of brands; (4)—Lower prices due to bulk purchasing where possible; (5)—Reduced oil cost by use of reclaimed lubricants.

The benefits created by the well-planned survey are substantial and

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For light duty pumping of hot or cold, thin or viscous liquids, use the Type GA . . . for heavy duty, hook up its big brother, the Type GR. Either way you're sure of the ruggedest construction and smoothest performance it's possible to build into a rotary pump. That's because both these hard working huskies incorporate the special herringbone rotors that operate so quietly and efficiently . . . combining with the whole advanced Worthington design for long, trouble-free, money-saving service. Get the whole story that proves *there's more worth in Worthington.* Write, describing your requirements to *Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, New Jersey.*

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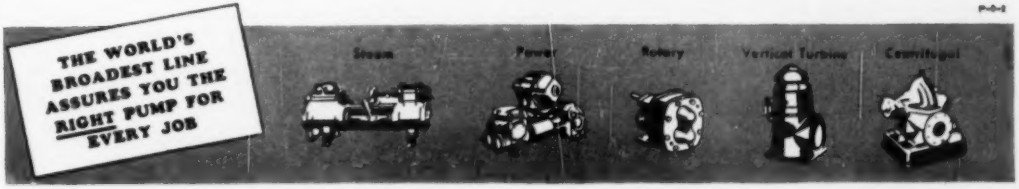

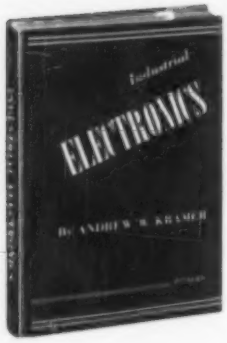

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warrant a special report to the management. In such a report it may be well to compare plant lubrication practice and cost before and after the survey as such comparison should show a real accomplishment.

This article has attempted to outline a method of improving the practice of lubrication in a plant.

Grouting Practice

(Continued from page 48)

cause of load vibration. The consequent dent in the wedge or peen area could well reach a depth of 0.010 to 0.050 in., which may be more than the elastic stretch of the foundation bolts. Under such conditions, the entire frame is loose and free to move as the unit vibrates.

Where wedges have been removed or jack bolts backed off, the machine weight of 60 t will not be supported on the six contact points, but will be evenly distributed over the entire contact surface of the grouted area. Foundation bolts should be checked for tightness when grout has been allowed to set seven days after wedges were removed and jack bolts backed off. Checking reveals that the bed plate is held firmly against the grout area with no chance to work free, as would not be the case when the weight would be riding on the small area on the wedges or points of jack bolts.

When riding on the wedges and/or jack bolts, the total weight is 10 t or 5 t per wedge or jack bolt whereas, with wedges removed the load is distributed to 16 or 17 psi. This nominal loading adds weight of the foundation to the unit to stabilize the equipment. This hypothetical case is based on actual grouting data and indicates that best results are obtained only by removing wedges and jack bolts. It is to be noted that the actual contact area between the 90 deg angle of the sole plate and wedge is not much greater than the oval contact between the jack bolt and shim plate—approximately one quarter of 1 sq in.

Whenever it is required to rush a job and to remove the forms sooner than normal, it is permissible to add one and one-half up to two per cent of calcium chloride by weight of the cement. The calcium chloride should be thoroughly dissolved in the mixing water before placing it in the dry grout mix. By the use of this admixture around the anchor-bolts, a much earlier grout strength will be obtained. Therefore, the loading of the bolts may be accomplished in much less time. Also the forms may be removed much earlier.

It is absolutely essential when using calcium chloride that the placing of the batch used around the anchor bolts not be delayed, but placed immediately after thoroughly mixing. This ingredient is an accelerator and stiffens the grout.

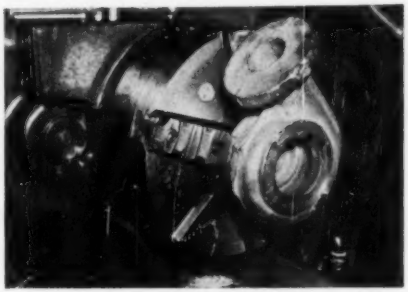
WHEN WELDS MUST BE MACHINABLE

1. The 45-pound iron pump casing shown above was defective as cast. Part of the intake flange was missing. A bad blowhole had all but destroyed an important boss.

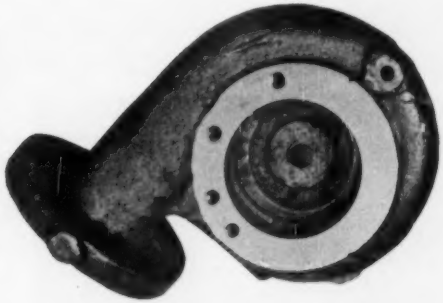
In many foundries the casting would have been scrapped, a red-ink entry on the day's production ledger. But not at this busy foundry!

2. The bad casting was sent to the welding shop with orders to repair if possible. And . . . thanks to NI-ROD . . . it was possible!

Defective areas were chipped out with a cold chisel and filled with five weld layers, two beads per layer. Each bead was wire-brushed before laying down the next deposit. 5/32 in. NI-ROD was used.



3. The welded flange face was turned down at 185 ft. per min., using a carbide cutting tool with .117-in. feed. The flange bore was machined at the same speed, using a tool steel cutter and .012-in. feed.



4. After machining, bolt holes were drilled and tapped in the weld, fusion zone and cast metal. Although there was a thin area of hardness at the surface near the line of fusion, no difficulty was encountered during any of the finishing operations.

Thanks to Ni-Rod's® dependability and ease of handling, the repair of defective iron castings is standard practice in many of the nation's busiest foundries.

Ni-Rod makes sound welds—*machinable* welds—with a minimum of preparation. Preheating and postheating are seldom required. Ni-Rod works well in all positions, giving good wash and easy slag removal. It is stable-arcing on both AC and DC currents.

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MAINTENANCE

201 Building Maintenance — Handbook 7, offers 64 pp of information on floor surfacings, leak stoppers, external wall sealants, road patching, roofing materials. Includes instructions for use. Flexrock Co.

202 Valve Maintenance Guide — "Prevent Valve Failure Before It Starts," is a 28-pp text on valve selection, installation, inspection. Pictures damaged valves, explains how damage could have been prevented. Discusses maintenance schedules, inspection jobs, lubrication, pipe line checking, threading, regrinding, disc replacement. Jenkins Bros.

203 Drip Preventive Handbook — Insulation of pipelines, tanks, cold air conditioning ducts and wall surfaces against corrosion and condensation drip is covered in pocket-size 32-pp Form F-17. Describes coatings, tells how to prepare surfaces and apply. Includes coverage tables, humidity charts. J. W. Mortell Co.

204 Industrial Maintenance and Construction Products — Here's a collection of data sheets giving product descriptions and directions for use. Covers heavy-duty mastic floorings, asphalt protective coatings, waterproofing and dampproofing materials, resilient floor covering underlayments, adhesives and cementing. The Flintkote Co.

205 Painting with Aluminum — Form AD-228, 38 pp, tells how and where to use aluminum paints. Covers painting of metal, concrete and masonry and other nonabsorbent surfaces; of weather-exposed wood, and of interior heated surfaces. Aluminum Co. of America.

206 Iron Cement Handbook — This is a 40-pp pocket-size catalog of iron cements for repair, other uses. Tells how to mix and apply them. Gives illustrated instructions for dozens of repair and maintenance jobs. Smooth-On Mfg. Co.

207 For Overhead Maintenance Jobs — This is a specification sheet on hydraulically raised rolling tower for one-man operation. Tells where unit is profitably used. Safway Steel Products, Inc.

208 Adjustable Scaffolds — Lightweight, aluminum alloy scaffolds with adjustable legs and built-in safety factors are described in this bulletin. Shows how easily scaffolds are carried and erected. Up-Right Scaffolds Div., Up-Right, Inc.

209 Small Scaffo'd — The merits of a small swinging scaffold for painting, other light-duty work are stressed in Bulletin C.P. 34. Explains safety features. The Patent Scaffolding Co., Inc.

CONSTRUCTION

211 Roofing Manual — Engineering data on roofing is given in Specifications 30, 30 pp. Covers coal tar pitch roofings, waterproofings, insulations, flashings, protective coatings. Includes excellent illustrated instructions for many roofing jobs. Tar Products Div., Koppers Co., Inc.

212 Hard Boards of Many Uses — Illustrated 24-pp booklet on Presdwood discusses its adaptability and types for exterior and interior use, giving physical properties. Covers finish specifications, edge and surface cutting, bending and finishing. Masonite Corp.

213 Steel Grating and Treads — Bulletin 2296, 24 pp, explains advantages of "Electroforged" steel grating, treads. Gives specifications, safe load data. Blaw-Knox Div., Blaw-Knox Co.

214 Building Panel Engineering Data — This 40-pp reference book on use of steel and aluminum panels for walls, decks and roofs, discusses their use, advantages, methods of installation. Covers acoustically treated panels, fire resistance ratings, electrification, acoustic roofs, reinforcing floor forms. Detroit Steel Products Co.

215 Roofing Sheet Application Data — Covers uses, characteristics, properties, installation, cost and availability of Monel roofing sheet. Includes tips on how to specify and table of theoretical weights of roofing sheet in available gages. Gives suggested gages for roofing, flashings, leaders. The International Nickel Co., Inc.

216 Glass Block and Where to Use It — This 32-pp book gives design data and general information on functional and decorative aspects of glass block. Covers properties, specifications, erection procedures. Insulux Div., American Structural Products Co.

217 Concrete Flooring — How a heavy-duty emery aggregate flooring meets production needs and solves special problems is told in Bulletin 601. Stresses durability, citing test results. Walter Maguire Co., Inc.

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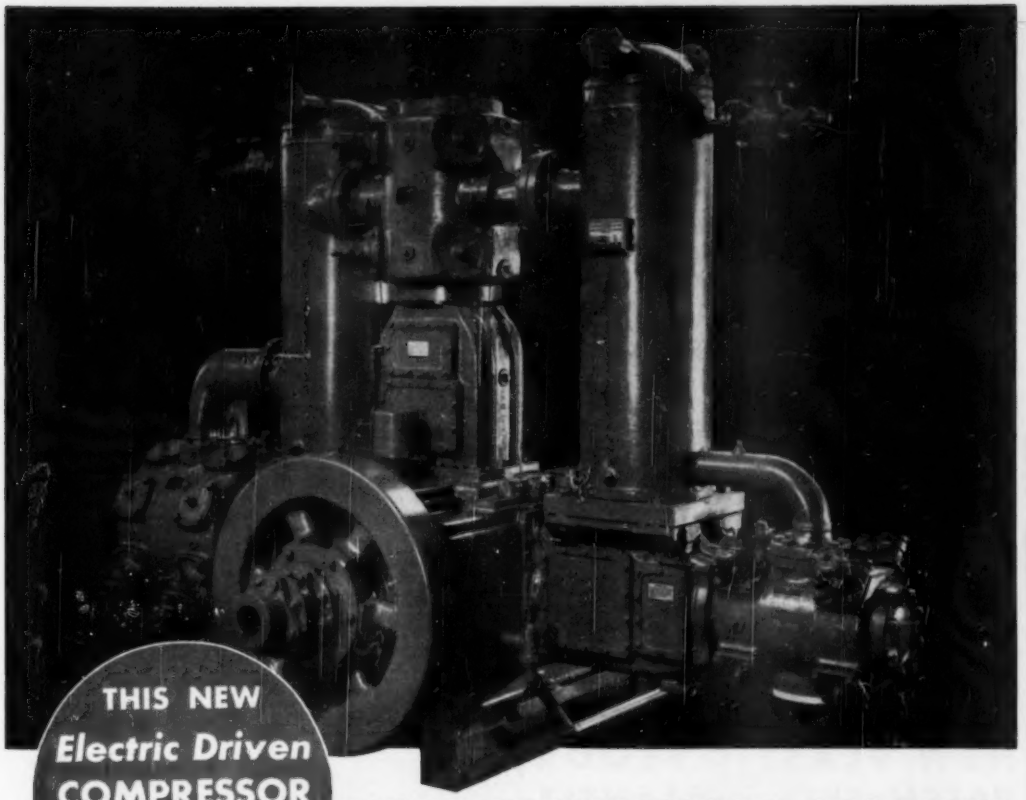

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218 Wire Partitions and Gates — Catalog 50 describes woven wire partitions, enclosure panels, window guards, gates. Pictures construction details, typical groupings of standard sections. Acorn Wire and Iron Works.

219 Walkways and Loading Racks — Part I, Section 6 of Catalog 54 is a 36-pp data book giving application suggestions on pre-cut steel material for on-the-job erection into walkways, stairways, loading racks; instructions on use of units, layout diagrams. Black, Sivalls and Bryson, Inc.

220 Technical Data on Plexiglas — This is a file folder of application information on Plexiglas sheets, rods and molding powders, covering workability, physical properties, thicknesses. Discusses use in large area lighting. Rohm & Haas Co.

221 For Daylight at Its Best — Form BRA 3-0749PBR tells why Alclo glass in daylighting installations promotes better seeing, less eyestrain, cooler interiors. Explains how it reduces solar heat. Tells how to select right type for individual plant needs. Blue Ridge Glass Corp. Libbey-Owens-Ford Glass Co.

ELECTRICAL

222 Motor Handbook — Bulletin MU-185 provides 60 pp of engineering and descriptive data on motors, covering splash-proof and explosion-proof types, gear motors, motors for use in chemical plants, for oil well pumping, punch presses, elevators, cranes and hoists. Includes prices. Wagner Electric Corp.

224 Selenium Rectifiers — Booklet DB-19-025, on standard and high voltage selenium rectifiers for power supplies and electronic circuits, includes efficiency curves. Covers service life, back leakage, reverse and forward resistance. Life characteristics for overload conditions or high ambient temperatures are plotted. Westinghouse Electric Corp.

225 Power Distribution Feeders — Catalog TEB-1, 40 pp, on heavy-duty units for main feeders in distribution system, gives construction details, engineering and application data. The Trumbull Electric Mfg. Co.

226 Precision Switches — Twenty-pp Catalog 81 covers industrial switches for a-c circuits. Describes general purpose basic switches, auxiliary actuators, enclosed, explosion-proof and splash-proof types, limit switches, small switches. Includes technical data, prices. Micro Switch.

227 Answer Card — Rules-of-thumb for answering questions on capacities and applying power-factor-improvement are printed on this small double card for computing answers to questions: How many kilovars? What power factor? How much voltage rise? Diagrams illustrate formulas. Apparatus Dept., General Electric Co.

229 Selector Switch Data — This folder of engineering information includes target sheet to aid in understanding company's push-pull selector switch. Features explanation on how switch provides single master control serving up to 16 operations. The Arrow-Hart & Hegeman Electric Co.

231 Electrical Diagram Guide — Electrical diagrams supplied with switchgear equipment are explained in Bulletin GET 1293A. Covers one-line, elementary, connection and interconnection diagrams; tells their scope; illustrates symbols used and common variations, and explains ASA device function numbers, conventions. General Electric Co.

232 Distribution Duct Engineering Data — Bulletin 427-4 contains 32 pp of data for estimating ventilated duct for feeder circuits, plug-in duct, and plug-in duct for branch circuits. Includes instructions for laying out distribution duct jobs, and pointers on estimating, diagrams, layout symbols. Bulldog Electric Products Co.

233 Manual of System Planning, Preventive Maintenance — This 50-pp book

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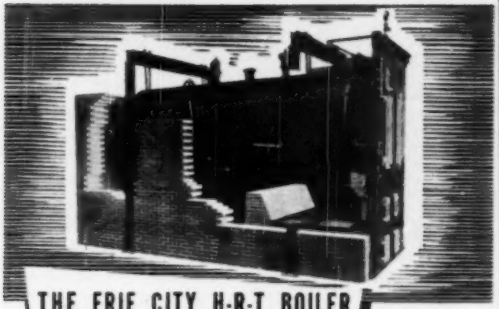

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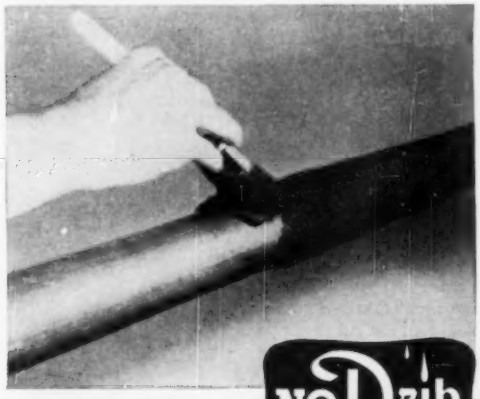

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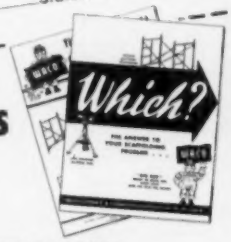

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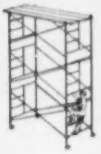

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234 Power Circuit Transformers — Folder C-15 on dry type power circuit transformers covers 50 to 15,000 va capacity units. Includes wiring diagram on higher voltage circuits. Jefferson Electric Co.

235 Planned Industrial Lighting — A manual of lighting application data, 36-pp Bulletin 1d describes a simplified procedure for laying out an installation according to lumen method. Includes table on trouble shooting, layout suggestions, coefficients of utilization, short-cut footcandle tables. Benjamin Electric Mfg. Co.

MATERIALS HANDLING

236 For Efficient Overhead Handling — Bulletin C-1, 56 pp, pictures overhead equipment for practically all industries. Stresses construction, safety, electrical advantages of trolleys, cranes, track and auxiliaries. The American Monorail Co.

237 Handling and Processing Equipment — Catalog 791, 32 pp, covers feeders, bin valves and level indicators, reduction machinery, vibrating screens and processing equipment, separators, elevating and conveyors, packers; chains and transmission machinery. The Jeffrey Mfg. Co.

239 Handling Equipment Ordering Book — Ninety-pp Catalog 23 describes power trucks, power jacks, stackers, cranes, hand trucks, platforms, storage racks. Fully illustrated. Lewis-Shepard Products, Inc.

240 Manual on Electric Hoists — Catalog H-46, 44 pp, covers monorail and stationary hoists and car pullers. Explains fundamental types of grabs, methods of hanging I-beams, types of hoist suspension, controls; gives dimensions. American Engineering Co.

241 For Overhead Moving — This is a booklet of engineering and application data on tramrail equipment, telling how it can improve plant's handling methods. Shows system's rail and arch design, switches, cranes and transfer bridges, hand-operated carriers, hoists, cranes, buckets, grabs. Cleveland Tramrail Div., The Cleveland Crane & Engineering Co.

242 Handbook on Overhead Conveying Systems — Manual A-56 provides 200 pp of information on overhead track systems and conveying equipment. Pictures installations, construction details; gives engineering and application data. Richards-Wilcox Mfg. Co.

245 Trucks, Handling Equipment — Bulletin 170A gives an over-all picture of company's power and hand lift trucks, portable and hydraulic freight elevators, other equipment. Revolvator Co.

246 Trucks, Casters, Wheels — Catalog 50, 64 pp, covers platform trucks, superstructures, two-wheel and pry trucks, dollies, trailers, casters, wheels, offering a wide range of chassis, superstructure and wheel combinations. Thomas Truck & Caster Co.

MECHANICAL POWER TRANSMISSION

247 Chain Drive Manual — Catalog SCE-50, 68 pp, on chain drives, cites advantages and recommends applications. Gives information on chain length calculations, installation and maintenance, ratings, chain types, pitch and sprockets. Includes prices. Whitney Chain & Mfg. Co.

248 Steel Shaft Data — Bulletin G-7, 20 pp, contains formulas, curves and tables for determining proportions, stresses, combined torsional and bending loads in round, square, hollow, keyway and stepped shafts. IMO-DeLaval Products Div., DeLaval Steam Turbine Co.

249 Gear-Type Coupling — Bulletin 101 tells why this coupling can provide long-run economy when used with gas blowers, turbine driven pumps, mills, compressors. Fast's Coupling Dept., Koppers Co., Inc.

250 Longer Life for Bearings — Bulletin 57B describes an economical three-step metallizing process which provides hard, oil holding surfaces for new and worn bearings. Metallizing Engineering Co., Inc.

251 Power Drive — This folder describes variable speed reduction units for ¼ to 2 hp drive requirements. Gives specifications, speed reduction ranges, prices for both regular and heavy-duty models. The Flinchbaugh Co.

PUMPS, COMPRESSORS

252 Pump Catalog — Turbine type and centrifugal pumps for industrial pumping jobs are described in this 12-pp booklet. Discusses features. Aurora Pump Co.

253 Centrifugal Pump Care — Sixteen-pp Bulletin 08X6256A is a handbook on the care of all makes of centrifugal pumps. Tells how to figure head, determine friction loss. Discusses causes of troubles and their cures, includes maintenance timetable. Tells how to prevent cavitation, common mistakes in packing stuffing boxes. Allis-Chalmers Mfg. Co.

254 Self-Priming Pump — Bulletin 636.1, on a new line of self-priming pumps, explains their valveless design and principle of operation. Goulds Pumps, Inc.

256 Centrifugal Pumps — Single- and two-stage pumps for such applications as small boiler feed service, cooling tower service, bottle washing, brine circulation, general water service, hot well service are described in Bulletin W-306-B1. Includes ratings, how to select a cold water pump. Worthington Pump and Machinery Corp.

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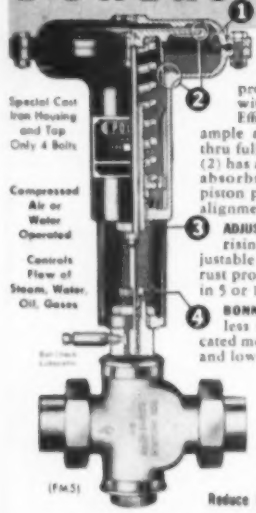
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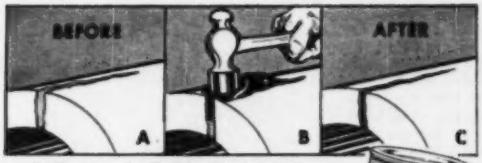

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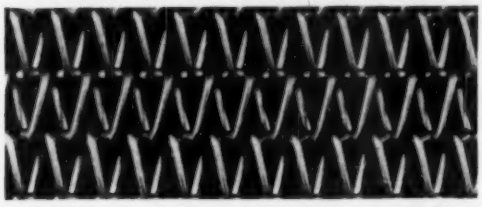

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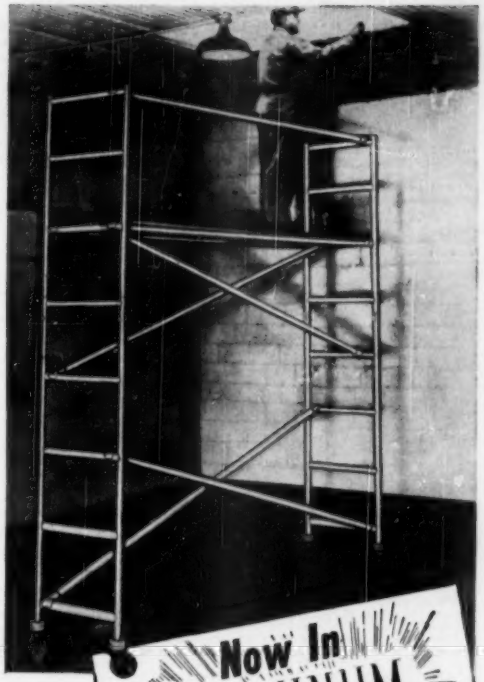

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257 Two-Stage Compressor — Data on a precision-built, two-stage, air-cooled compressor is given in this 16-pp bulletin. Includes selection chart showing dimensions, cylinder arrangement. Joy Mfg. Co.

PIPING, TRAPS, FITTINGS, STEAM ACCESSORIES

258 How to Cut Steam Costs — Bulletin 250 tells how a differential drainage and boiler return system reduces steam costs. Layout drawings of installations included. Stickle Steam Specialties Co.

259 Steam Trap Manual — "Solving Steam Trap Problems," 36 pp, covers correct trapping practice for unit heaters, jacketed kettles, autoclaves, submerged surfaces, steam mains, header drips. Tells how to select size, determine lift of trap. Describes simplified piping for traps. Also discusses float traps, air release valves, strainers. The V. D. Anderson Co.

260 Steam Hook-ups—This 64-pp manual on hook-ups for steam traps, air vents and temperature controls provides diagrams, size calculations, selection data on traps and regulators, properties of saturated steam, dimensions. Sarco Co., Inc.

262 How to Choose and Use Air Traps—Bulletin 202 describes air trap selection and installation for automatic drainage of moisture from compressed air intercoolers, aftercoolers, receivers, separators and drip points. Tells how traps work, where to use them; includes prices. Armstrong Machine Works.

264 Handbook on Fittings, Flanges — Catalog wf-1950, 88 pp, offers working information on seamless carbon steel welding fittings and forged steel flanges. Includes dimensional tolerances, thread standards and threading practice; service pressure ratings, physical and chemical requirements. Grinnell Co., Inc.

CUSHION STYLE TIRES

Will be used on towing tractor and two fork lift trucks

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The new demountable tire has a tapered hard-rubber base reinforced with bead wires and it can be applied to a tapered base wheel by bolting together the two wheel halves with a standard wrench; an Allen wrench removes the plugs. Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.

VALVES

265 Bonnet Valves — "Pressure-Seal" bonnet valves are described in Form AD-1819. Includes sizes, ratings, and tests for gate, globe, angle and stop check valves as recommended for high pressure and temperature service. Tells their operating advantages, how seal is made. Crane Co.

266 Reducing Valve Engineering Data—Bulletin 962 explains how the contour of a pressure reducing valve contributes to efficiency of performance. Discusses straight-line flow, wide opening and tight closing. A. W. Cash Co.

267 General Service Valves — Bulletin E-160, 16 pp, describes design and construction of quick-operating valves, explaining their application to blow-off service and on fire protection, chemical process, soot blower, water column blow-down pipe lines. Gives prices. Everlasting Valve Co.

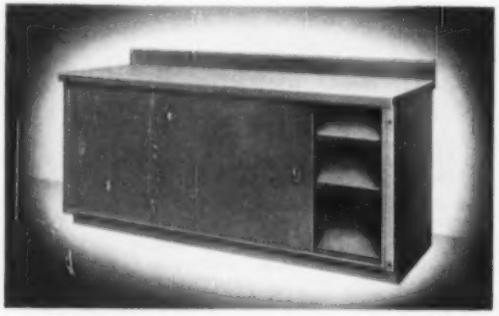
268 Technical Data on Controls, Control Valves—Information in this bulletin includes solutions to problems involving use of pressure switches, and applications where pressure or vacuum changes are converted into electrical power. Also provides data on four-way solenoid valves for control of air, water or light oil. Barksdale Valves.

269 Solder Joint Valve — Bulletin 103 describes a 100-lb valve for use with copper tubing. Gives working pressures, temperatures. Tells how to install a solder joint valve. The Kennedy Valve Mfg. Co.

HEATERS, HEATING

270 Space Heaters—The use of warm air space heaters in tempering make-up air is explained in Bulletin 520, which also discusses other applications for the heaters. Dravo Corp.

(Continued on page 102)



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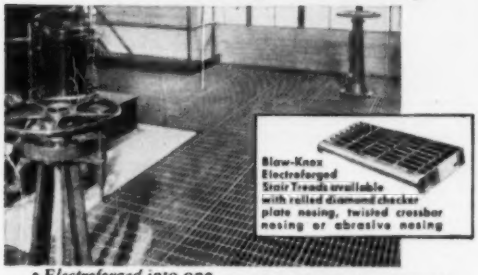

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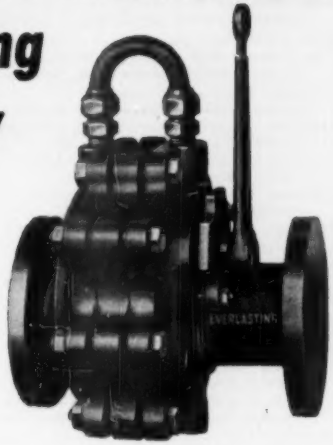

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272 Heat Exchangers — Bulletin 11.0.080 describes air cooled heat exchangers for condensing or cooling of steam or process vapors, natural gas, jacket water, lubricating oil, quenching baths. Equipment Div., J. F. Pritchard & Co.

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273 Hydrometers for Industry — Bulletin 0, 16 pp, presents hydrometers graduated in conventional scale ranges for routine testing, special instruments of extreme accuracy, standard instruments. Gives ranges, intervals of graduation; includes density and volumetric tables. Precision Thermometer & Instrument Co.

274 Pressure Regulator—Bulletin 1-B, 8 pp, discusses design, operation and uses of a super-sensitive pressure regulator. Also covers a compound regulator for controlling back pressure relief valve and high pressure make-up valve. Atlas Valve Co.

275 Control Equipment—Thirty-pp General Catalog 601 is on measuring and control equipment for water and sewage works, power and processing industries. Describes venturi tubes and meters, controllers, gages, manometers, pilot equipment. Includes capacity tables, layout drawings. Simplex Valve and Meter Co.

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276 Zeolite Softeners for Small Plants—Publication 4505 describes junior industrial type zeolite softening equipment for plants requiring less than 100 gpm of softened water. Discusses single and double units, exchange materials. Cochrane Corp.

278 Boiler Water Treatment Methods—File SM-9020 discusses ways of applying chemicals in water treatment. Covers pre-treatment of raw water make-up, feeding equipment, constant rate and flow responsive feeding to feedwater systems and direct to boiler drum, flushing periods, condensate returns and condenser water, chemical tanks. % Proportioneers, Inc. %

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VENTILATING, AIR CONDITIONING

280 Fans, Unit Heaters—Ordering and engineering data on direct-connected centrifugal fans, self-cooled motor propellor fans, self-cooled motor unit heaters, and light-duty electric ventilators given in Bulletin S-309. ILG Electric Ventilating Co.

281 How Conditioning Units Can Help—The advantages of self-contained units in cooling, dehumidifying and cleaning are cited in 40-pp Catalog 1307. Explains installation, operation. Provides data on direct expansion cooling, cold water cooling, hot water heating, steam heating; speed, horsepower tables. Clarage Fan Co.

282 Improved Air Conditioning—Advantages and applications of a controlled humidity method of air conditioning are discussed in Bulletin 112. Process is explained, illustrated. Niagara Blower Co.

283 Heavy Duty Ventilation Filters—Form DPF-100, LH presents a dry-panel filter providing a filtering area of 28 sq ft. Tells special features, uses of these filters; includes installation data, filter selection chart. Dollinger Corp.

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284 Tool Catalog — Hand and power tools, tool sets, kits and related equipment are presented in 110-pp Catalog T. Includes descriptive, ordering and application data. Snap-On Tools Corp.

286 Welding Electrode Ordering Guide—Pocket-size Catalog R7-7 on electrodes for hard surfacing and for welding stainless, alloy and mild steels, includes operating characteristics, current ranges, tensile strengths, polarity. Harnischfeger Corp.

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287 The Why, What and How of Lubricants—This 20-pp booklet explains and illustrates common tests and terms describing lubricants. Covers viscosity, flash and fire, neutralization, number, penetration, specific gravity, extreme pressure, steam emulsion, corrosion. Tide Water Associated Oil Co.

288 Viscosity of Fluids—The larger significance of viscosity is discussed in Nos. 5 and 6, Vol. 36 of Lubrication, a technical publication. Illustrates simplest conception of streamline flow between two surfaces having relative motion. Shows how viscosity acts and may be measured. Covers streamline flow in small tubes, turbulent flow in pipes. The Texas Co.

291 Four Handy Guides for Plant Engineers—Bulletin 20B6051J, 12 pp, offers data on figuring V-belt drives; Bulletin 51B-6025K, 12 pp, for quick selection of electric motors; Bulletin 52B6059E, 16 pp, for selection of centrifugal pumps, and Bulletin 25B6051B, for power generation, distribution and control equipment. Specify booklets wanted. Allis-Chalmers Mfg. Co.

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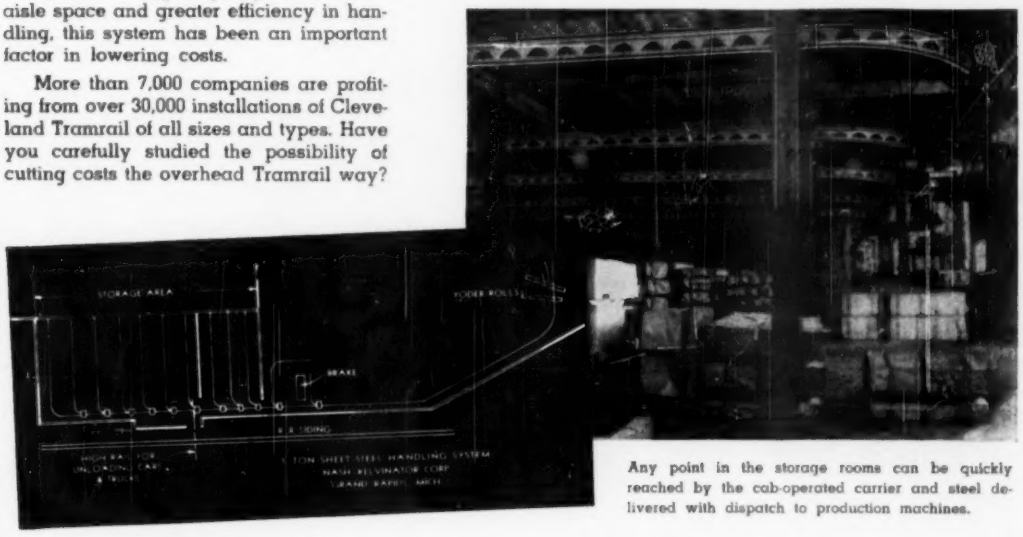

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